

Drought: What is the Status?

Nolan J. Doesken
Colorado Climate Center
Colorado State University

<http://ccc.atmos.colostate.edu>

Presented at 2005 Peak to Prairie Landscape Symposium,
February 11, 2005, Colorado Springs, Colorado
Prepared by Odie Bliss



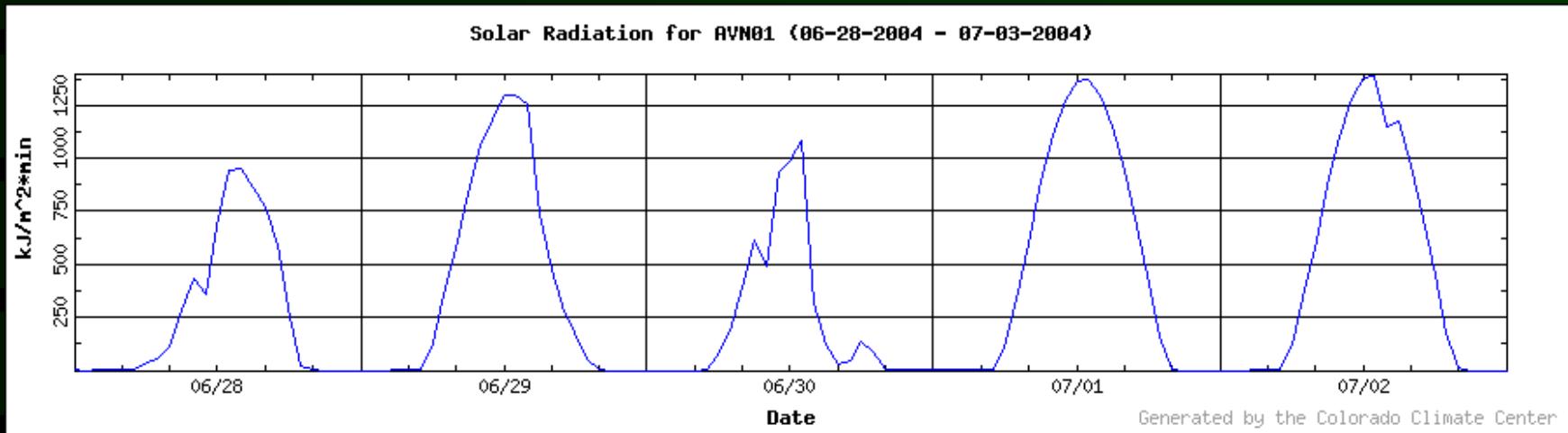
Our climate is great – sort of



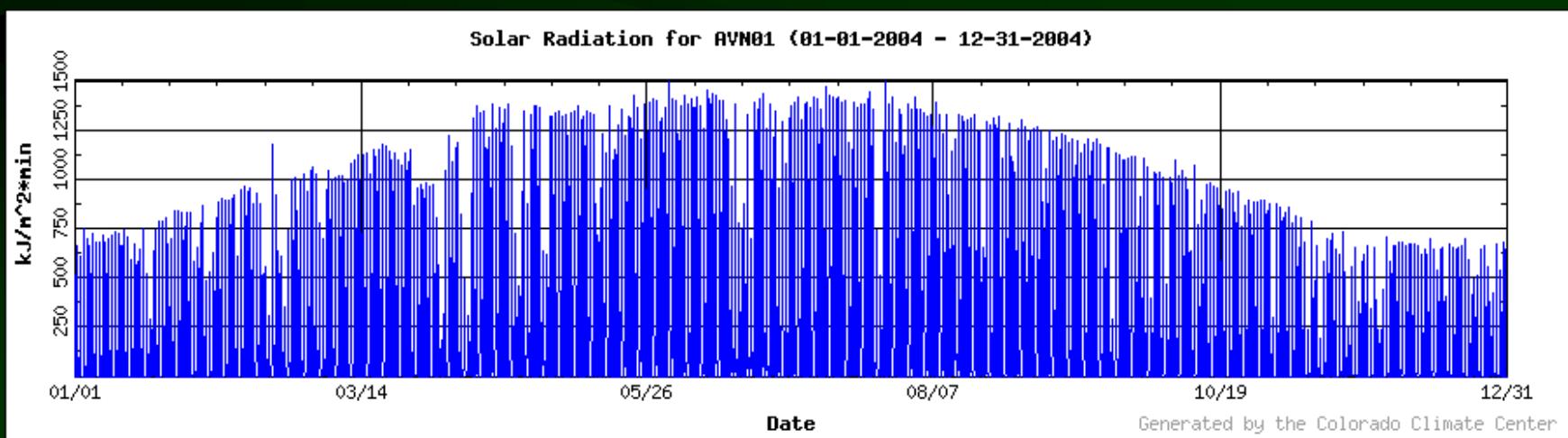
<http://www.lensflare.com/~doubt/pics/garden/>

Solar Energy Drives Our Climate

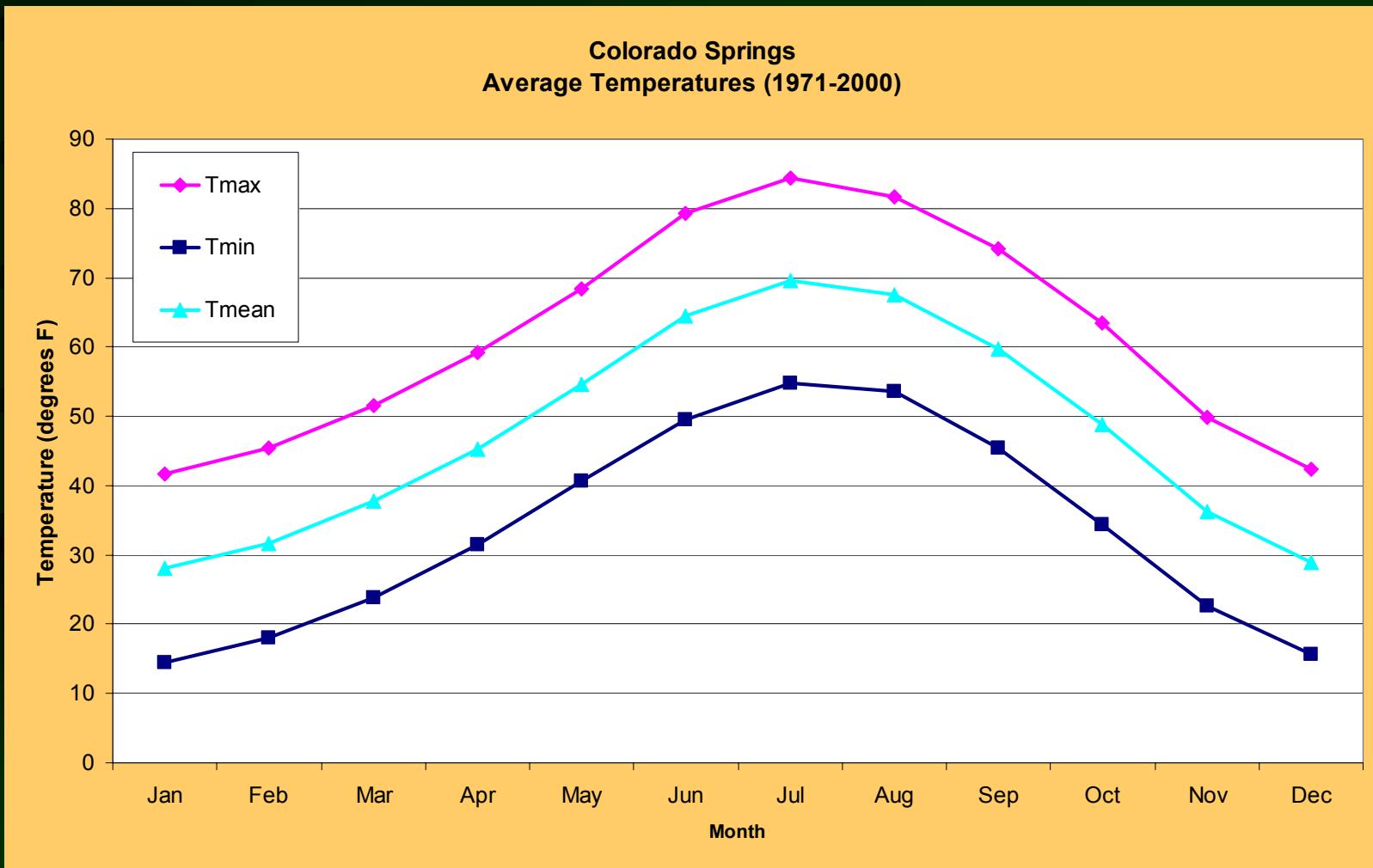
Avondale, June 28 – July 3, 2004



Avondale, June 28 – July 3, 2004

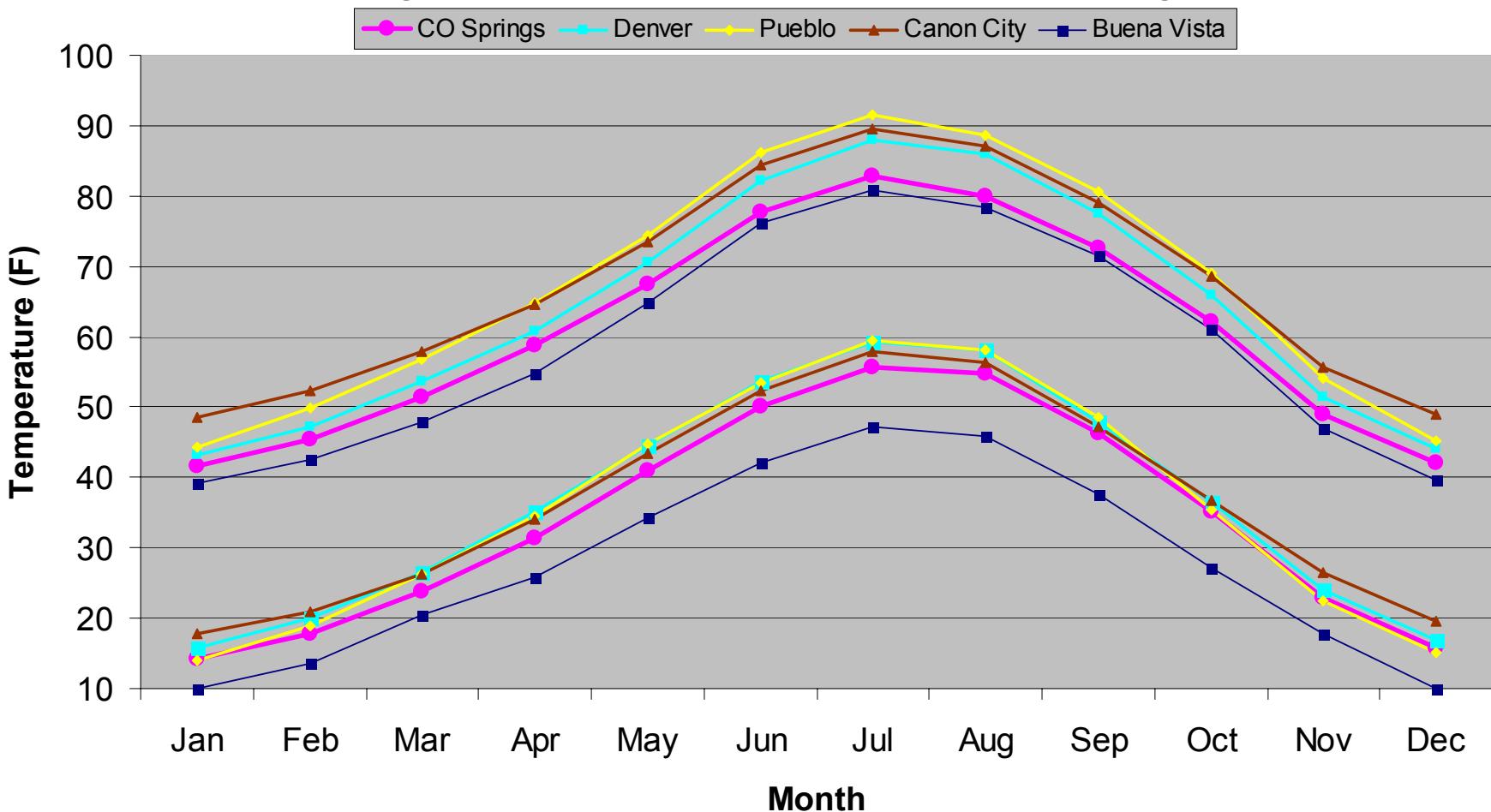


Colorado Springs Average Temperatures

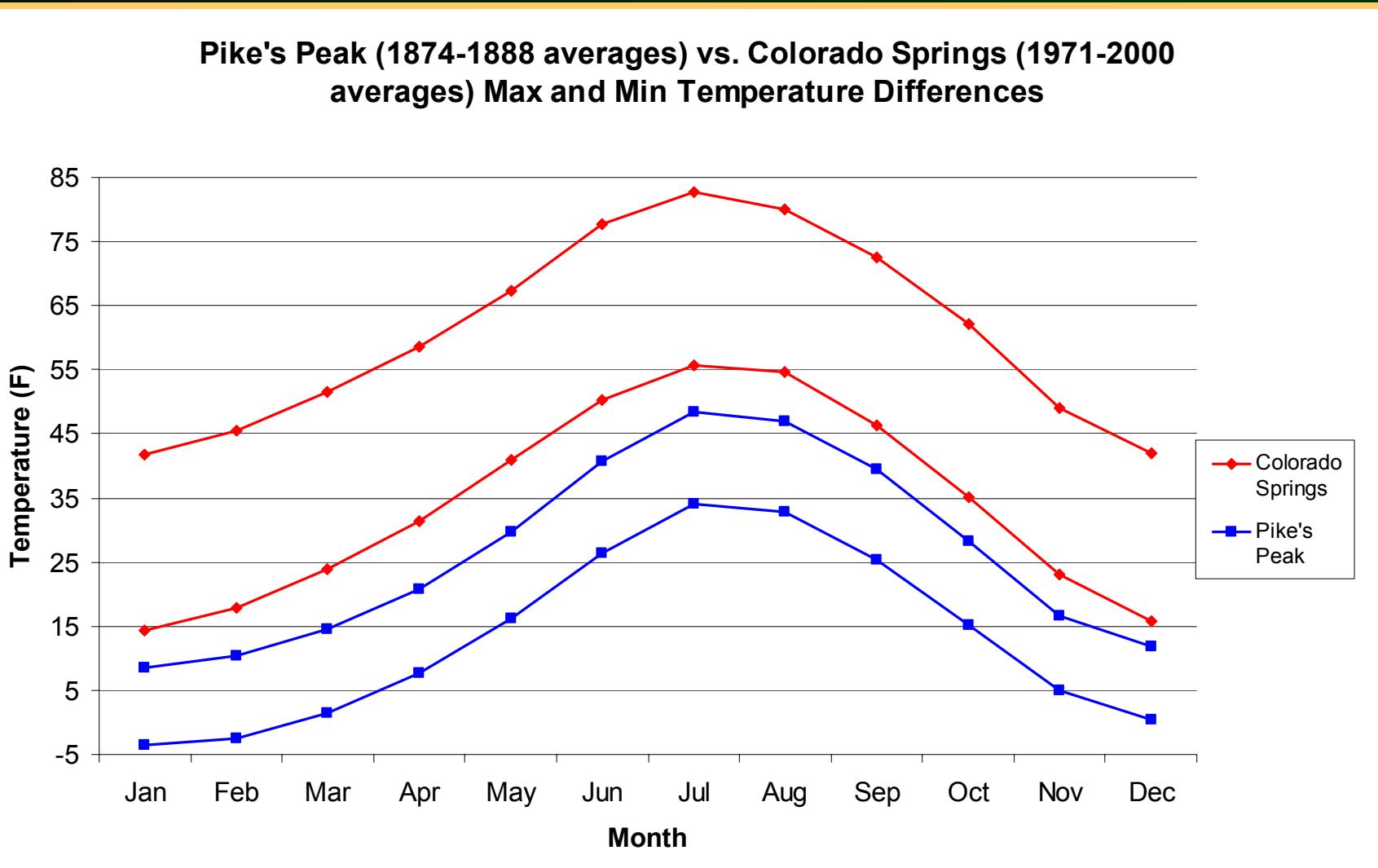


Comparison of Average Temperatures

Colorado Springs, Denver, Pueblo, Canon City and Salida
Average Max and Min Temperatures (1971-2000 averages)

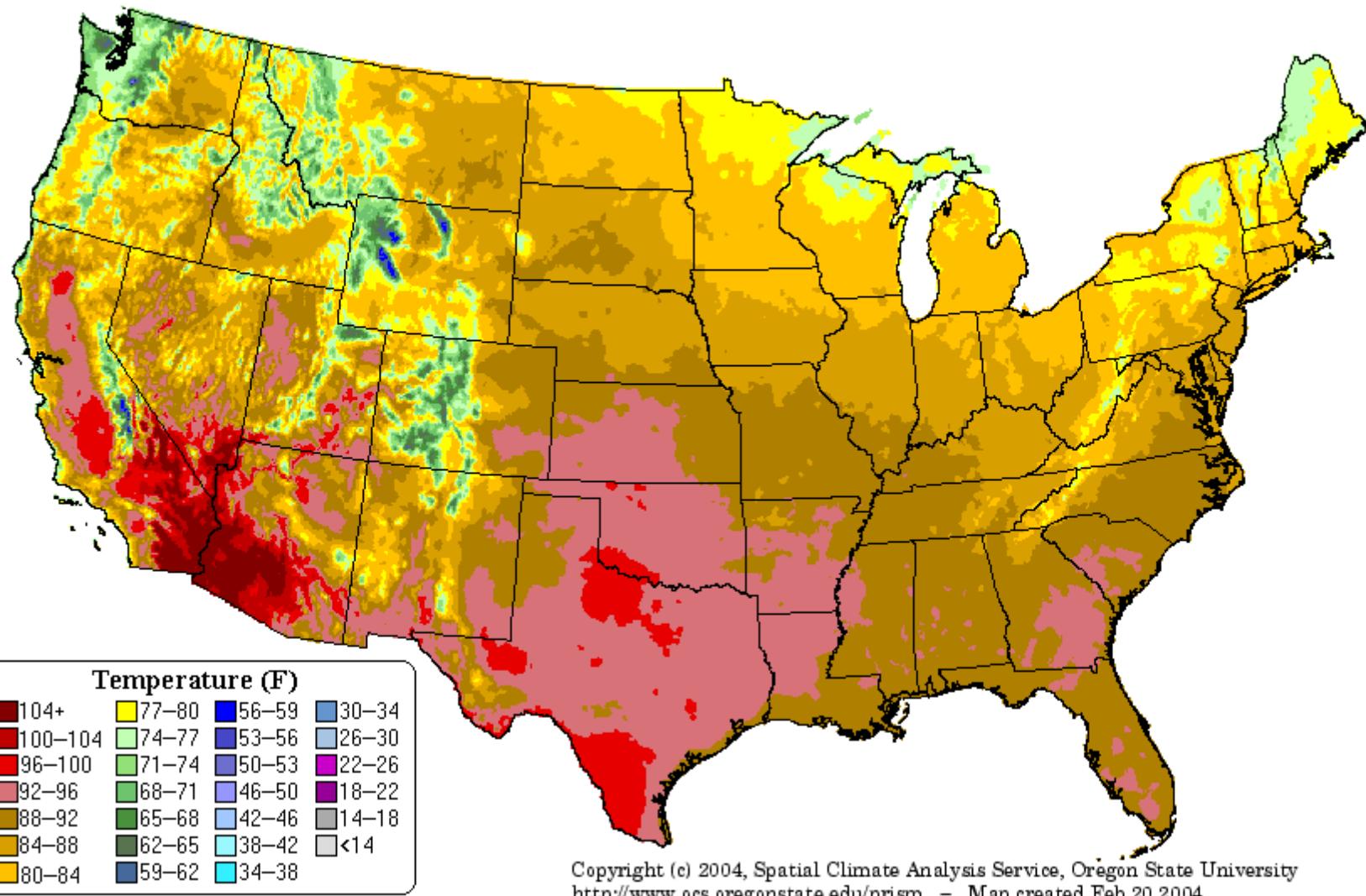


Pike's Peak vs. Colorado Springs



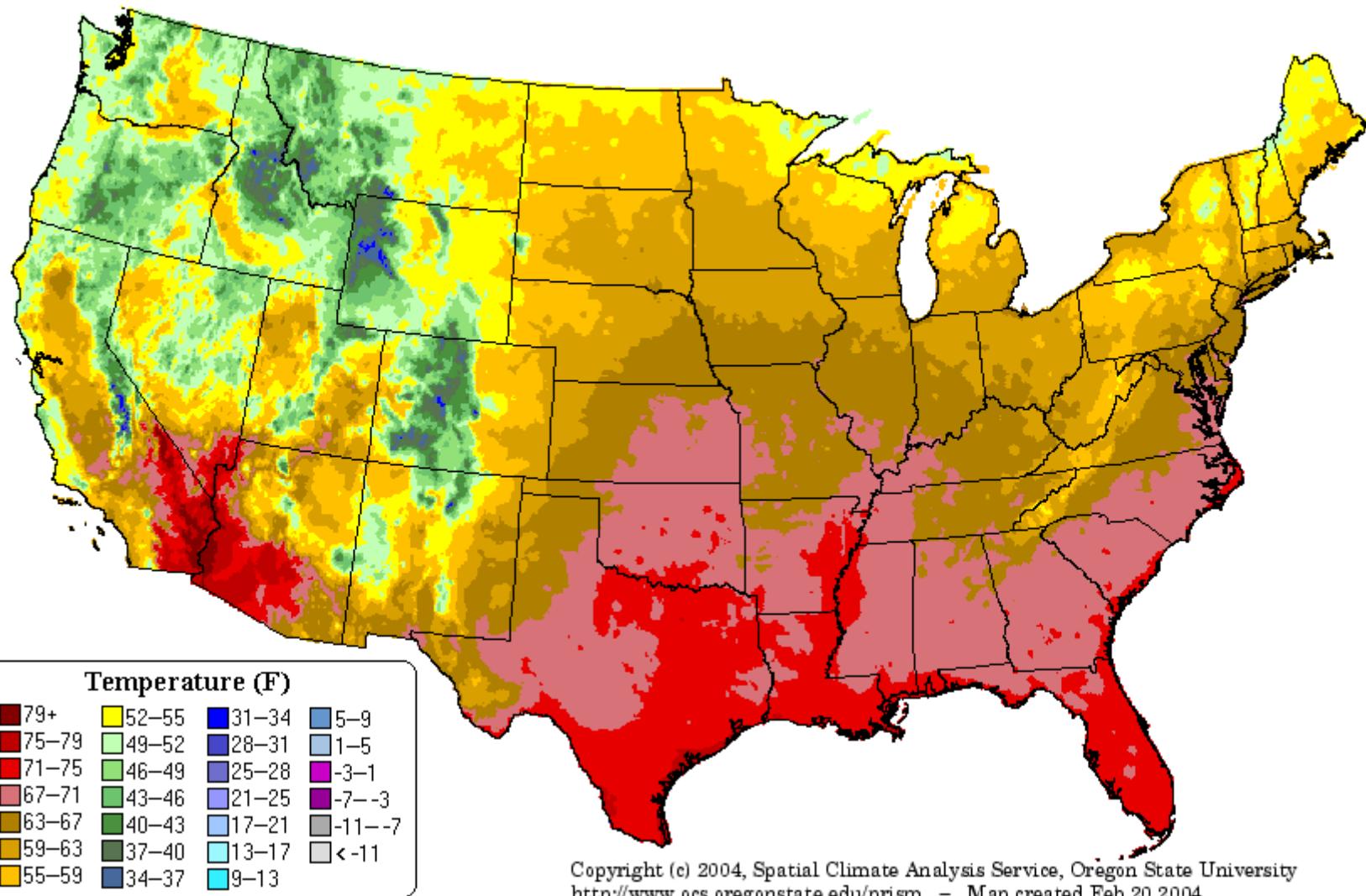
Summer Temperature Perspective

Maximum Temperature: July Climatology (1971–2000)



Summer Temperature Perspective

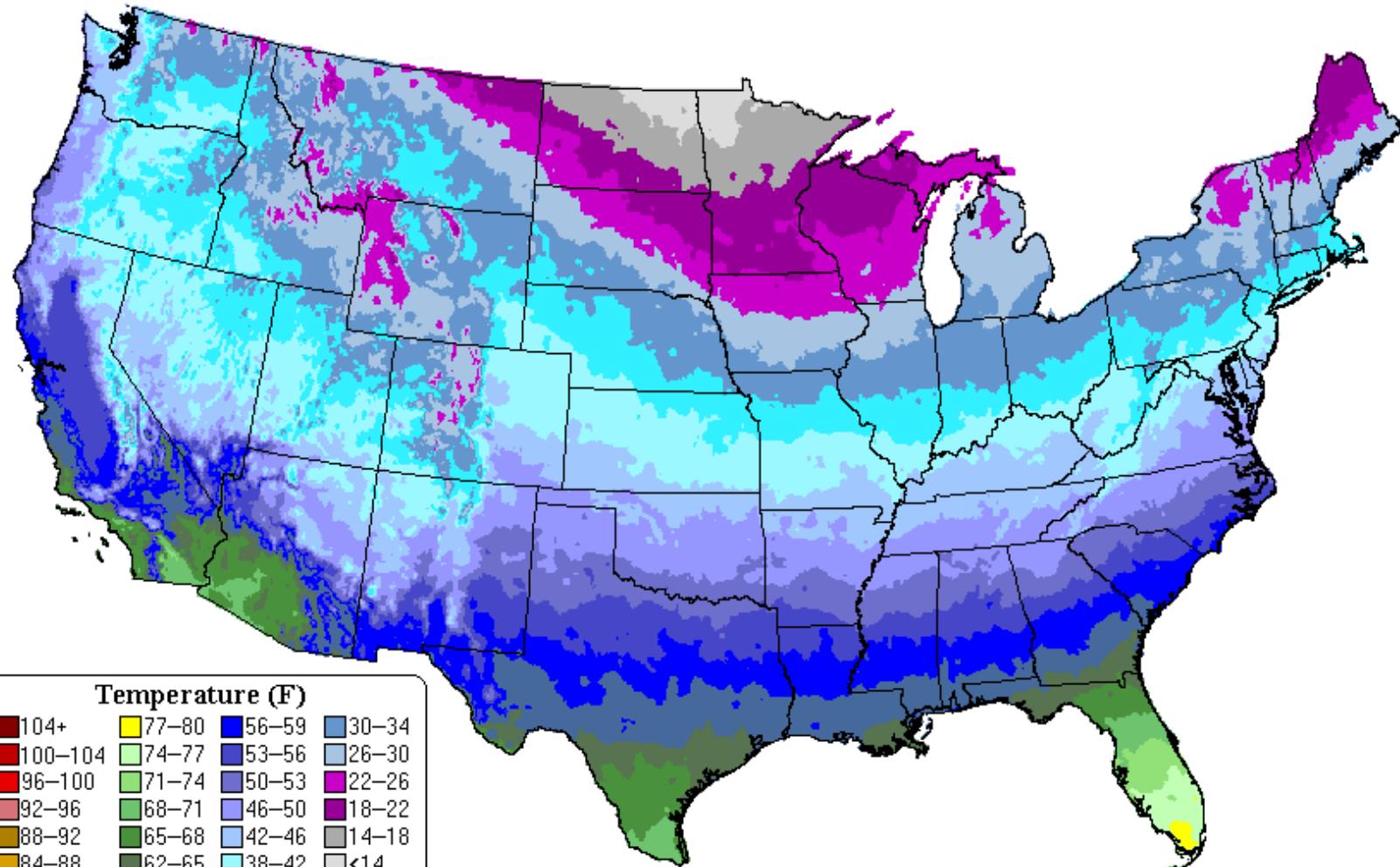
Minimum Temperature: July Climatology (1971–2000)



Copyright (c) 2004, Spatial Climate Analysis Service, Oregon State University
<http://www.ocean.oregonstate.edu/prism> – Map created Feb 20 2004

Winter Temperature Perspective

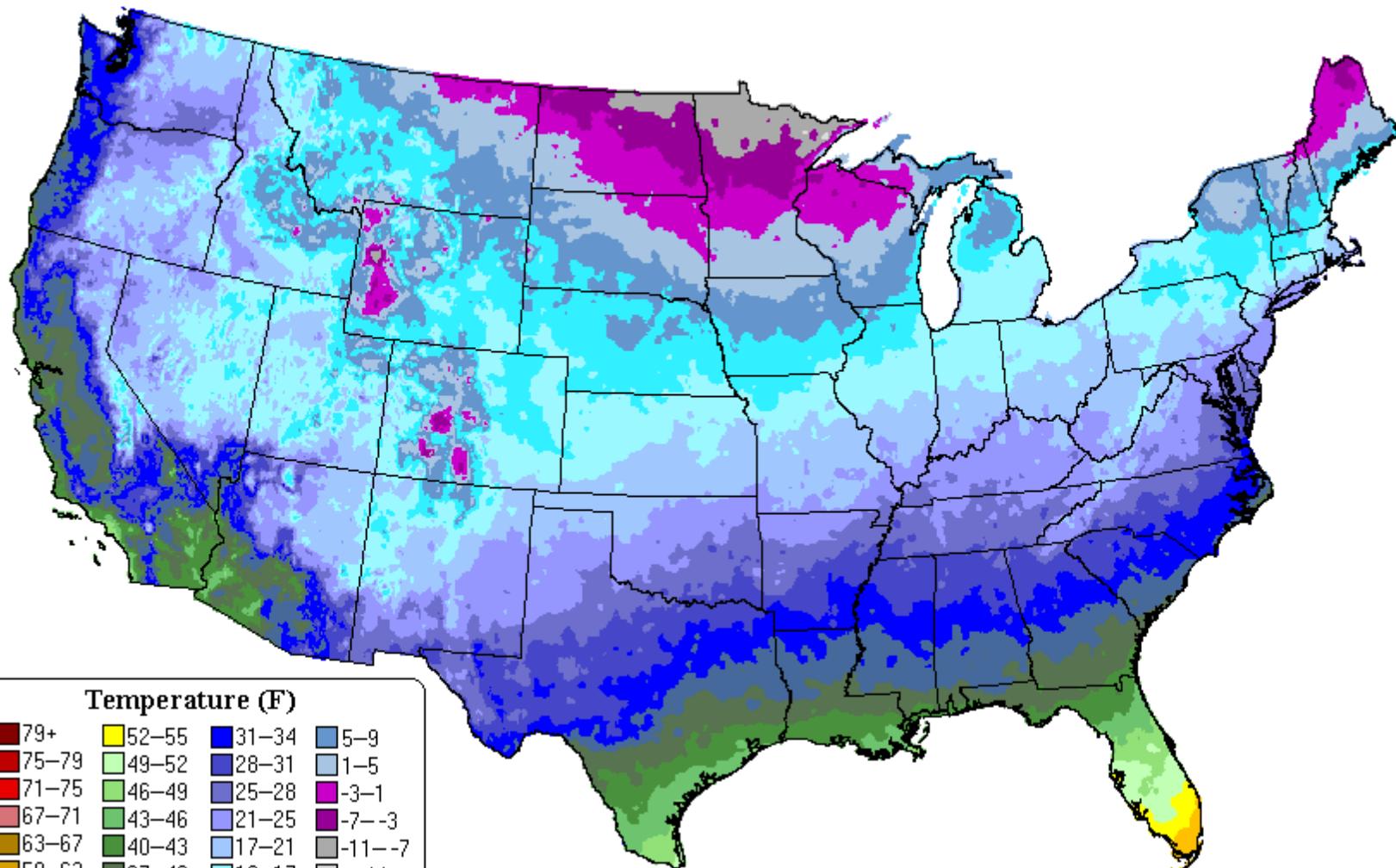
Maximum Temperature: January Climatology (1971–2000)



Copyright (c) 2004, Spatial Climate Analysis Service, Oregon State University
<http://www.ocs.oregonstate.edu/prism> – Map created Feb 20 2004

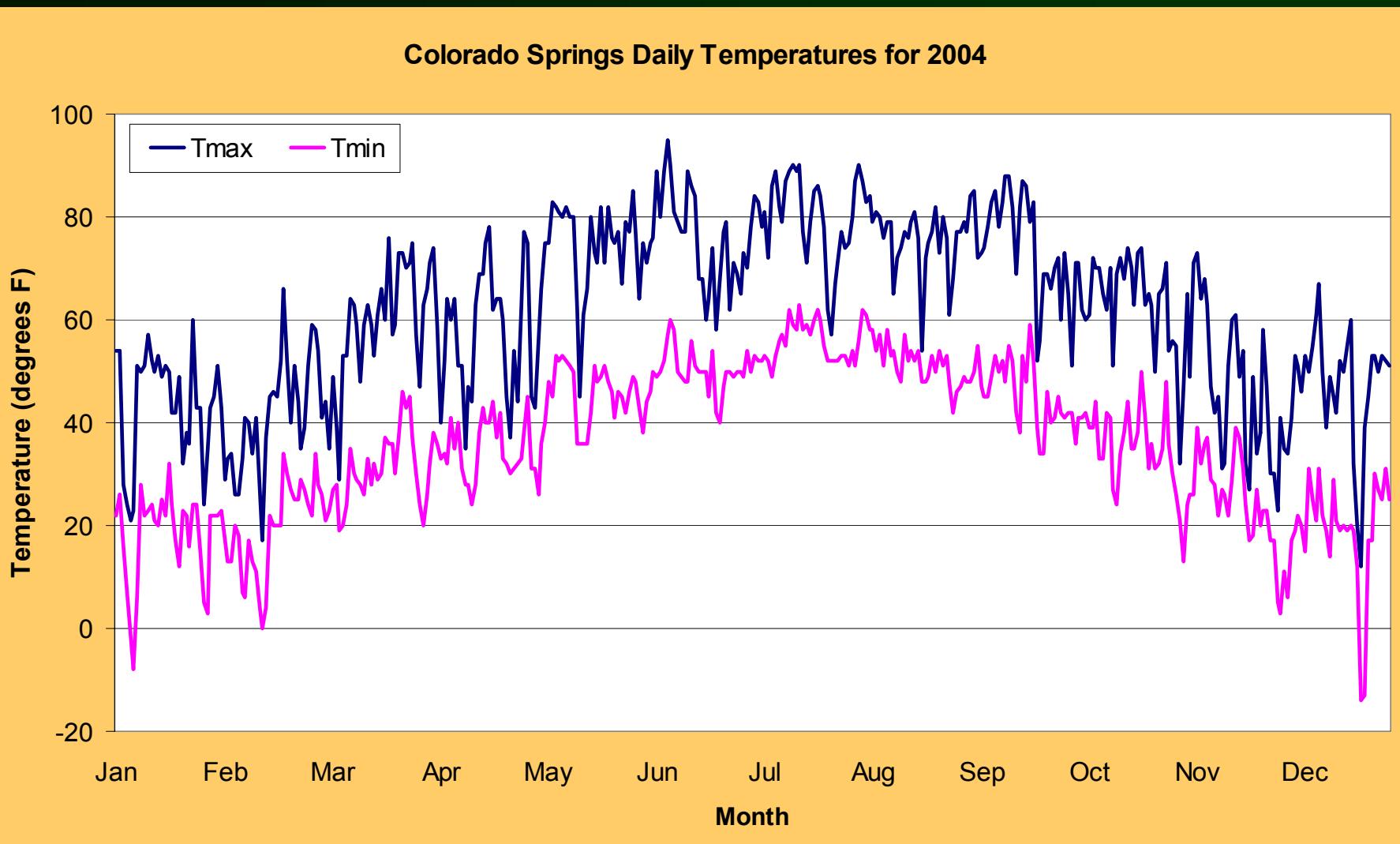
Winter Temperature Perspective

Minimum Temperature: January Climatology (1971–2000)



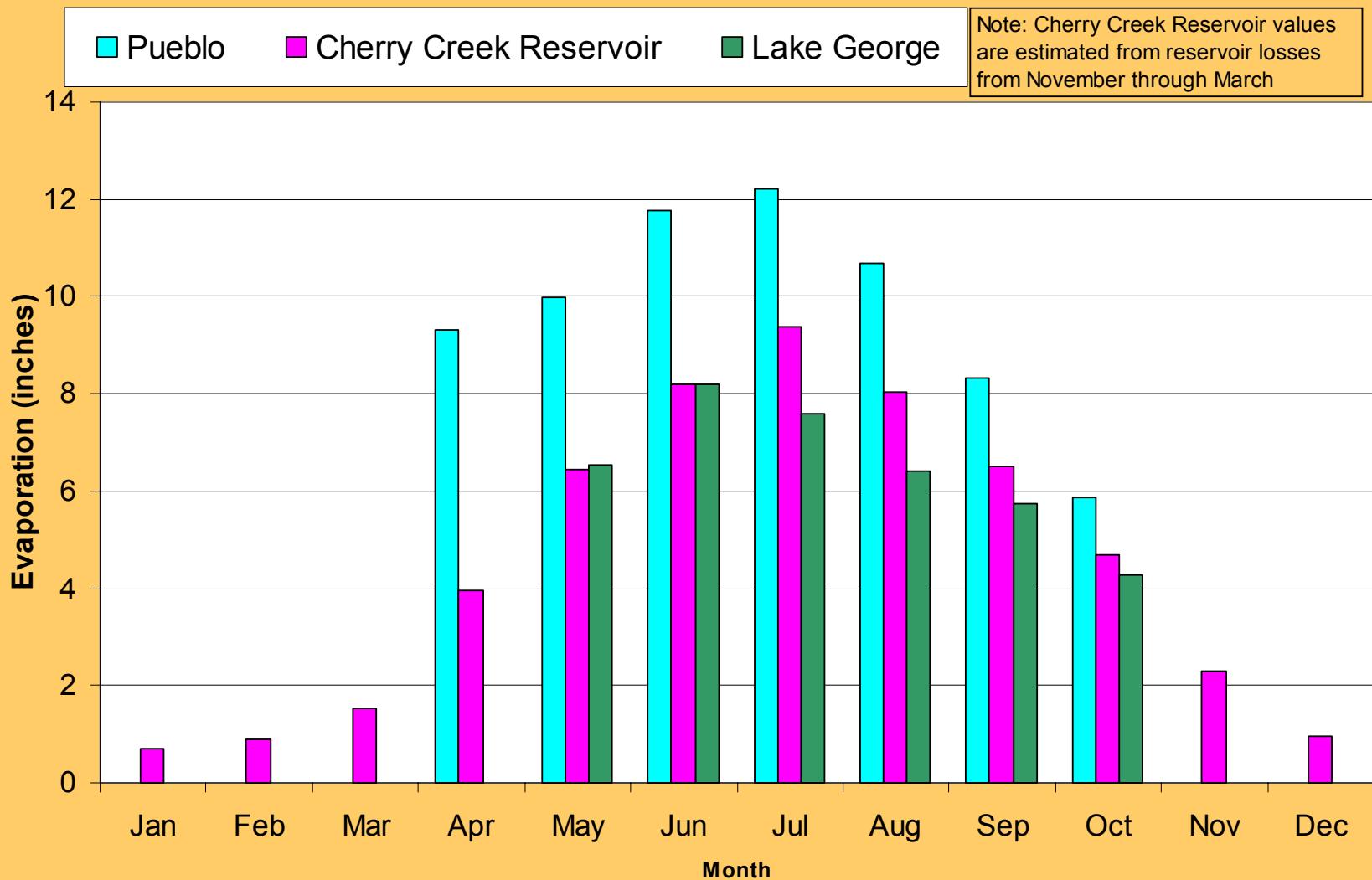
Copyright (c) 2004, Spatial Climate Analysis Service, Oregon State University
<http://www.ocs.oregonstate.edu/prism> – Map created Feb 20 2004

2004 Daily Temperatures for Colorado Springs

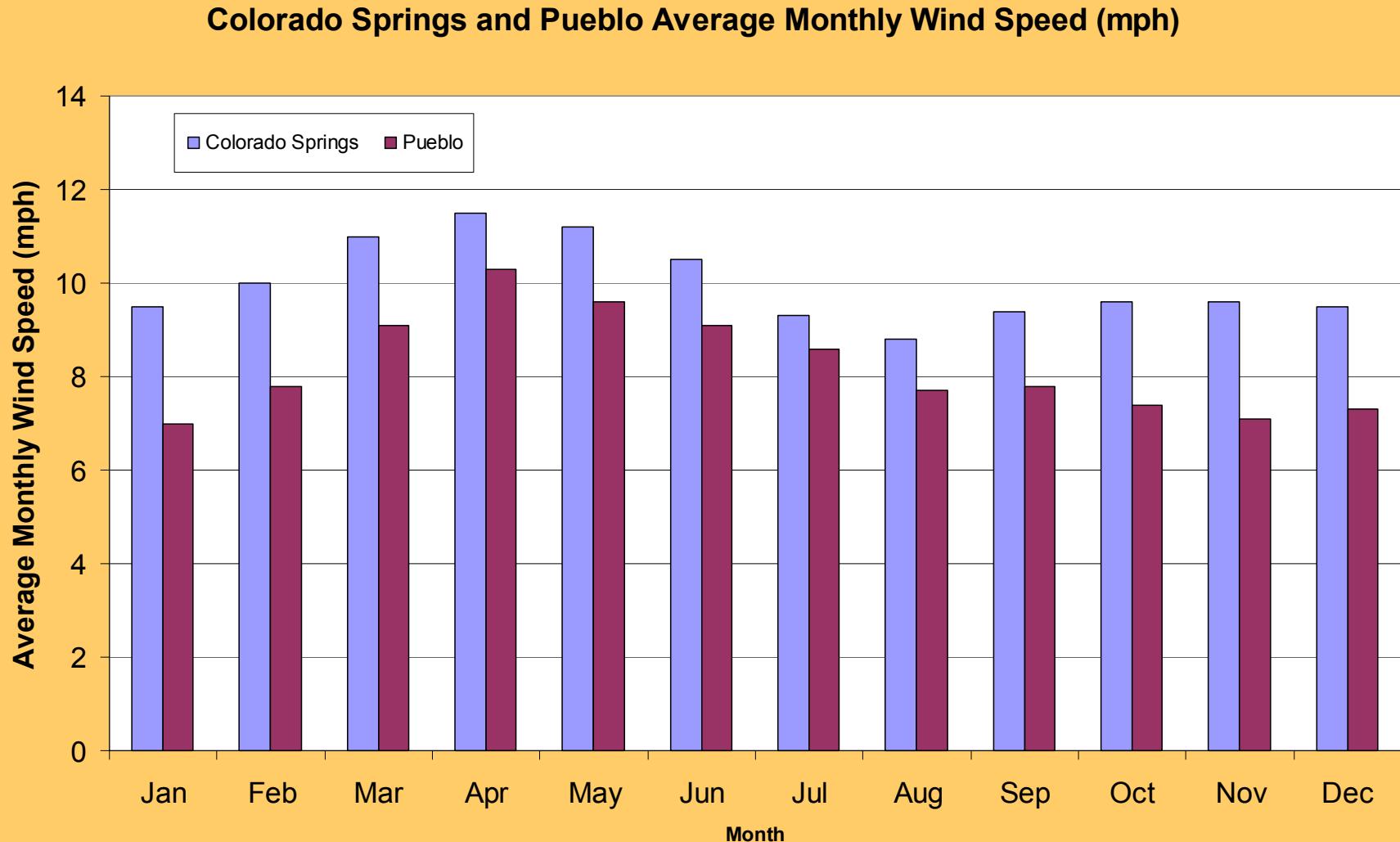


Mean Monthly Pan Evaporation

Average Monthly Pan Evaporation



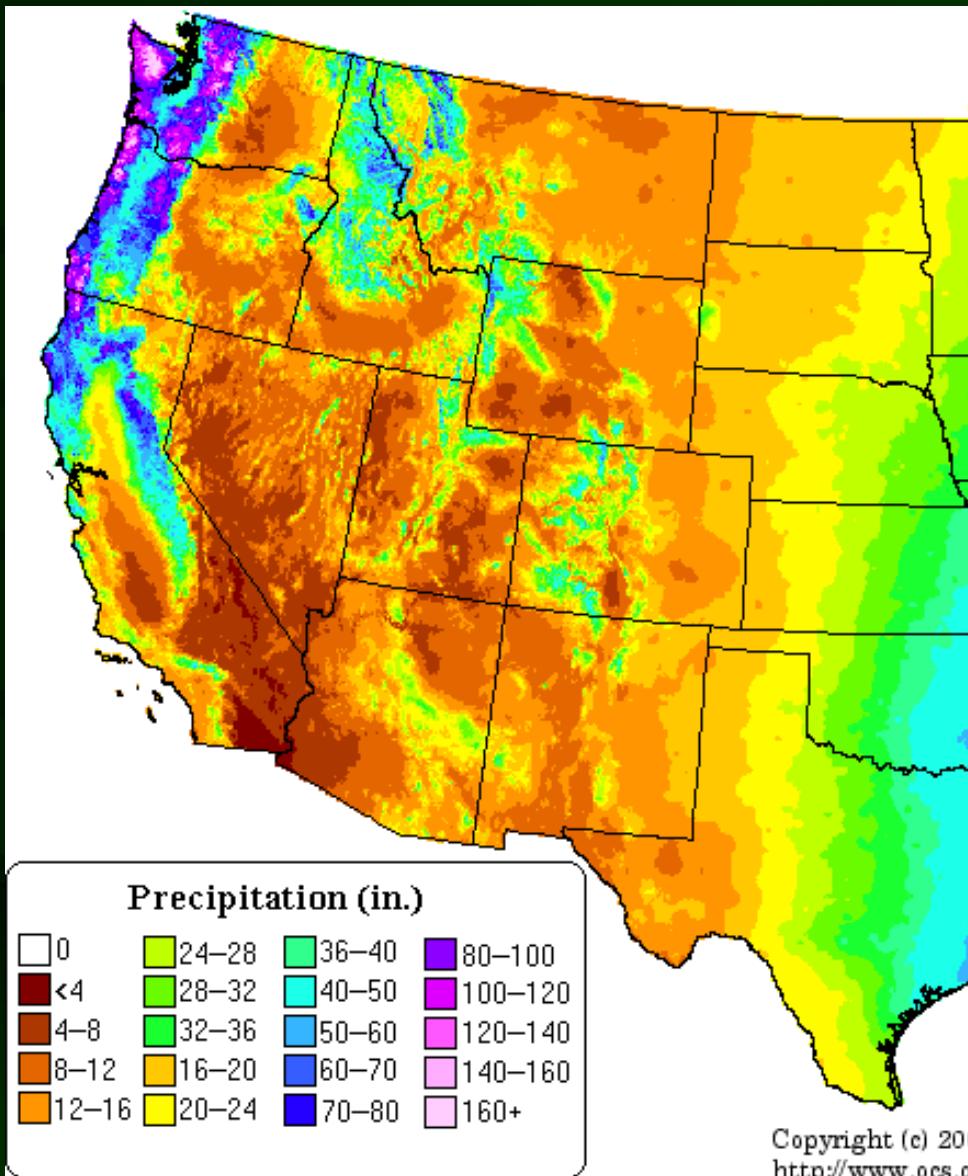
Colorado Springs and Pueblo Average Wind Speed





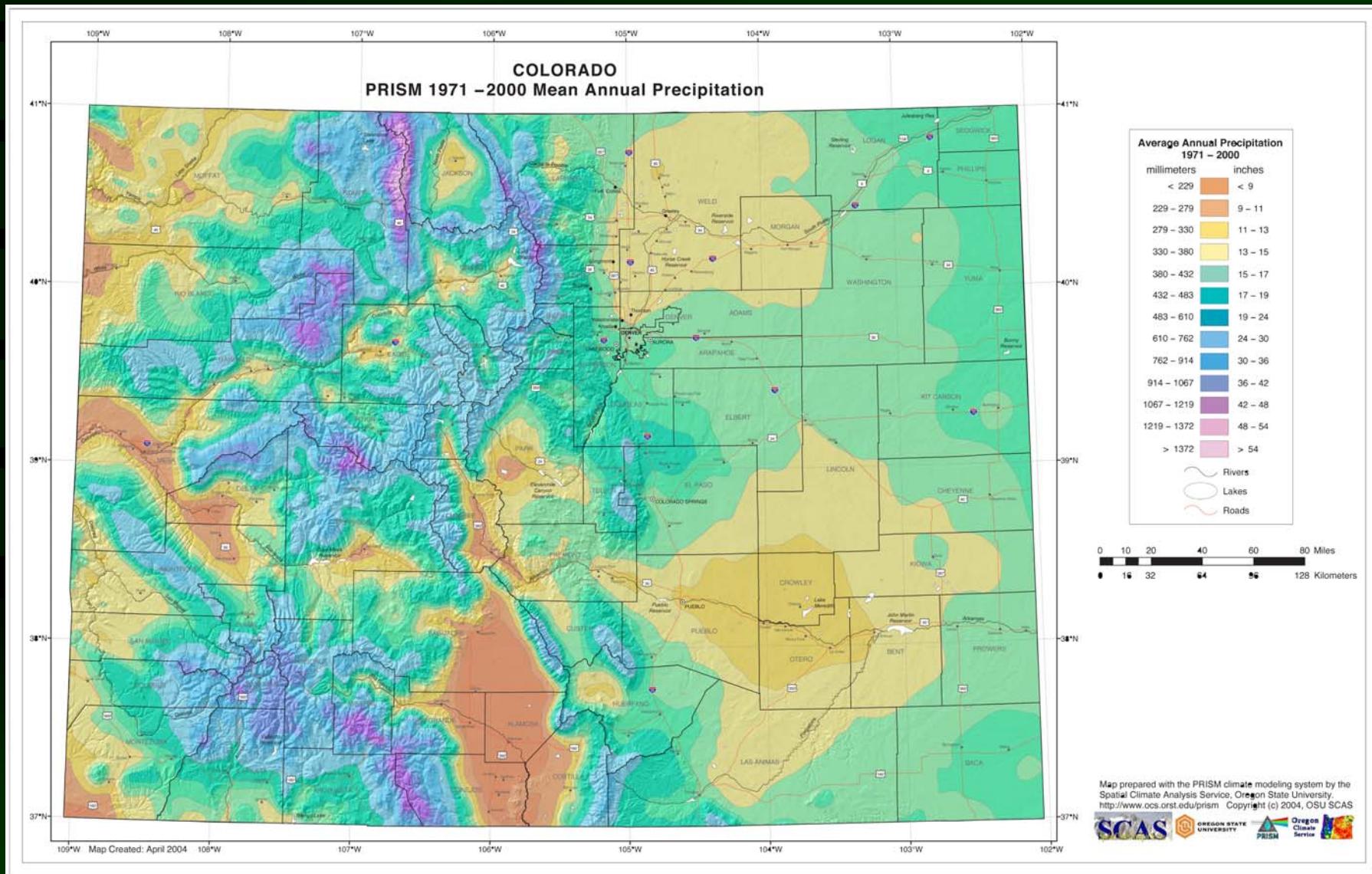
Precipitation – The most variable of all!

Precipitation: Annual Climatology (1971-2000)



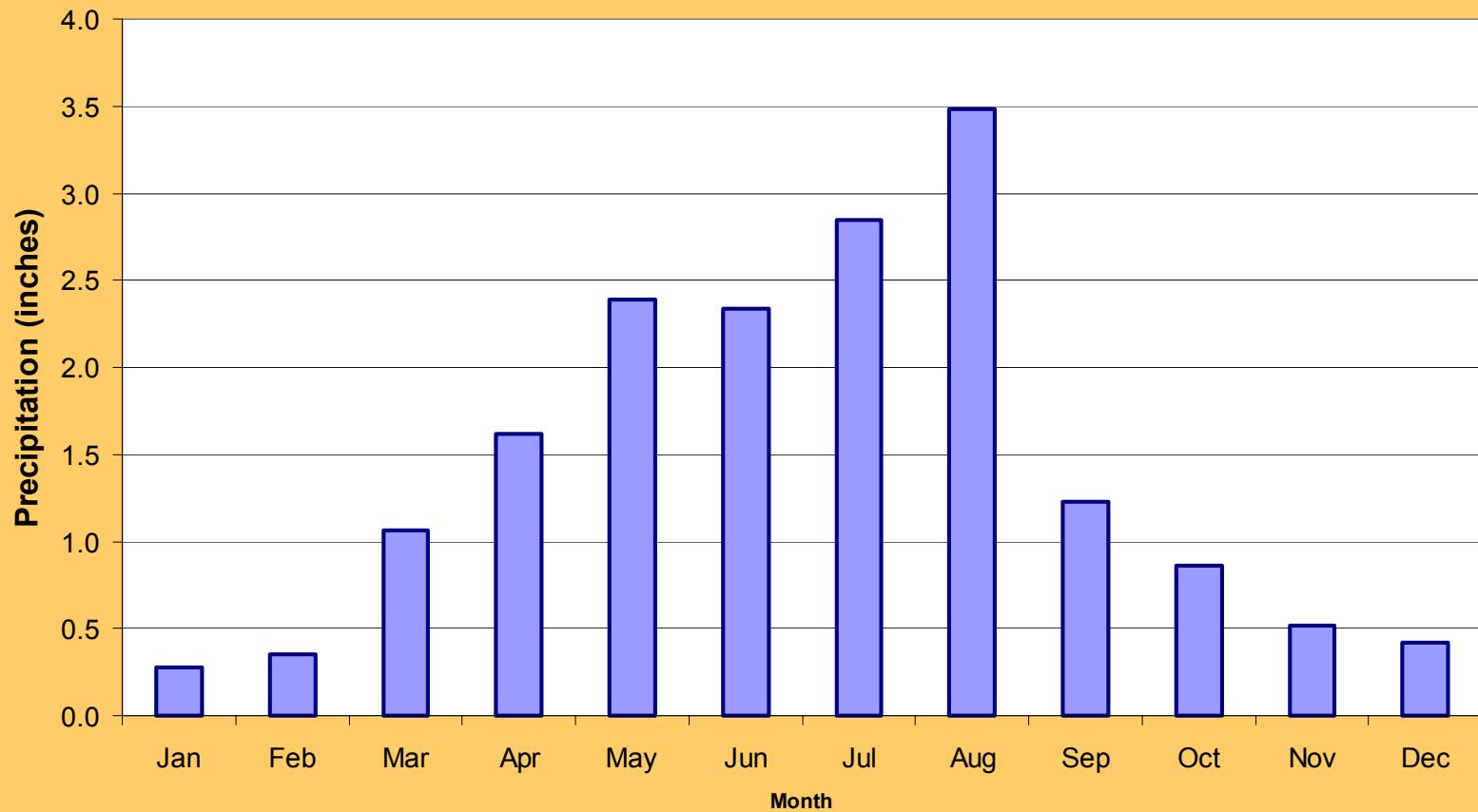
Copyright © 2004, Spatial Climate Analysis Service, Oregon State University
<http://www.ocs.oregonstate.edu/prism> - Map created Feb 20 2004

Colorado Average Precipitation



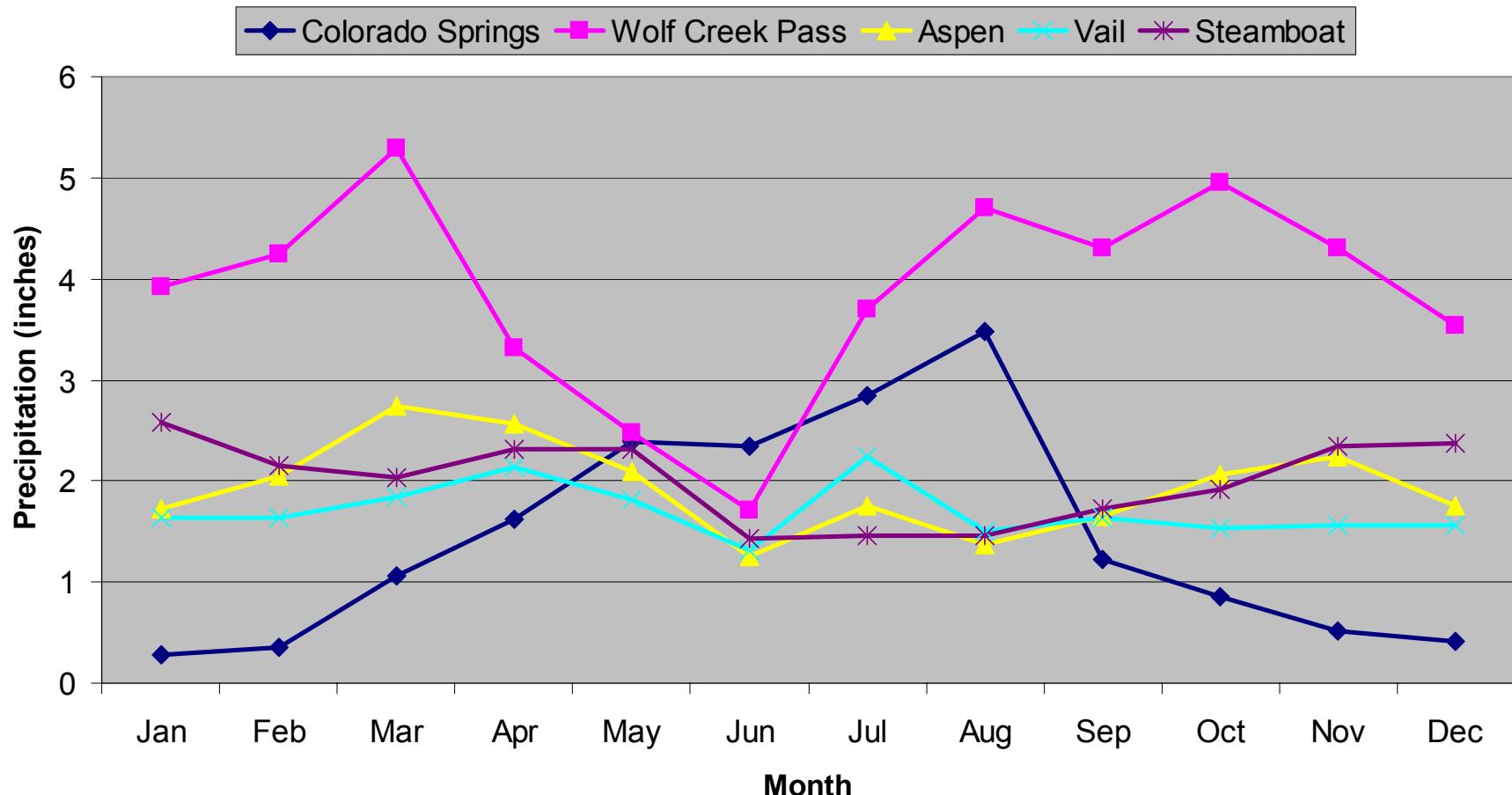
Colorado Springs Monthly Average Precipitation (1971-2000)

Colorado Springs Average Precipitation (1971-2000)

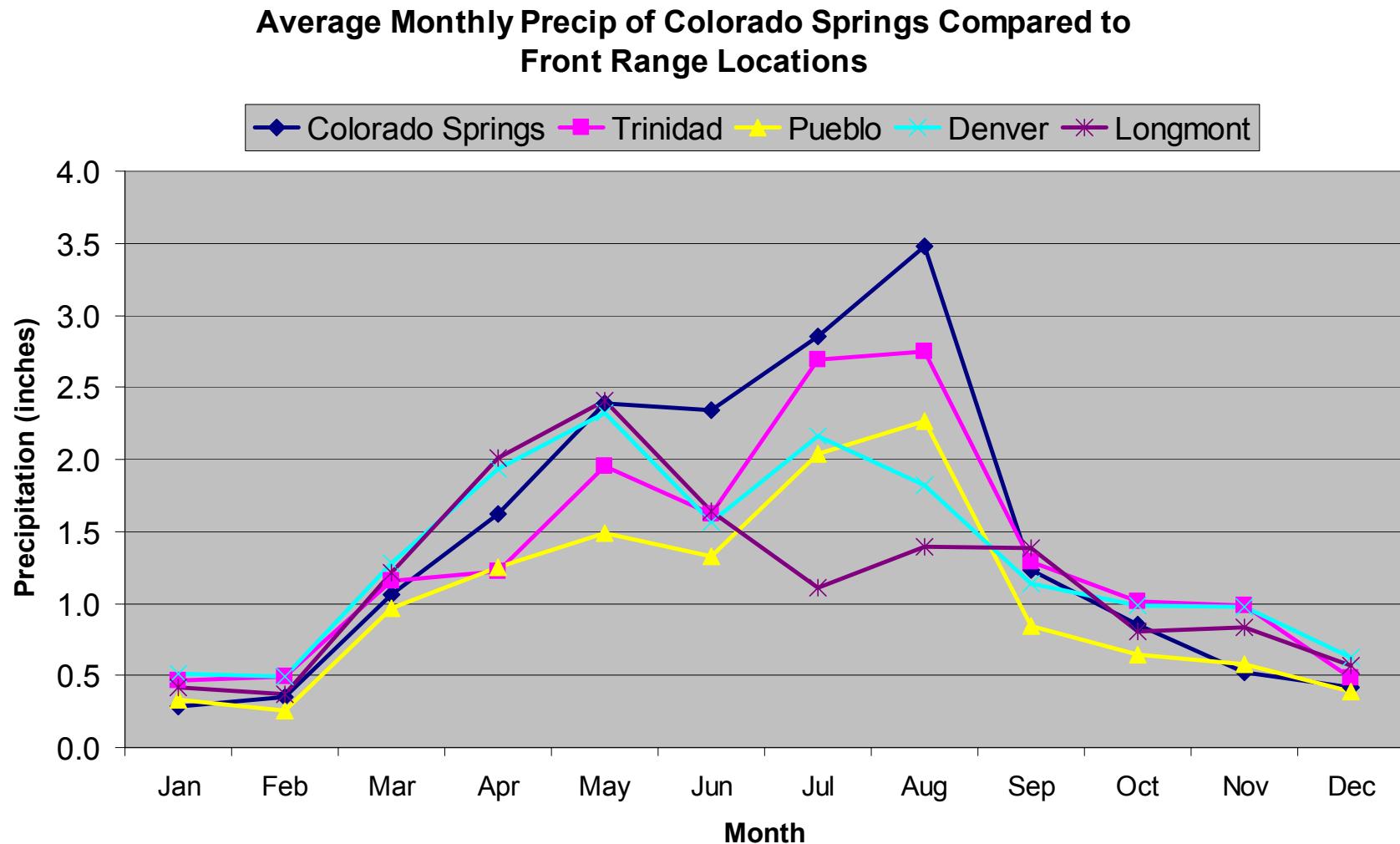


Average Monthly Precipitation Compared to Mountain Locations

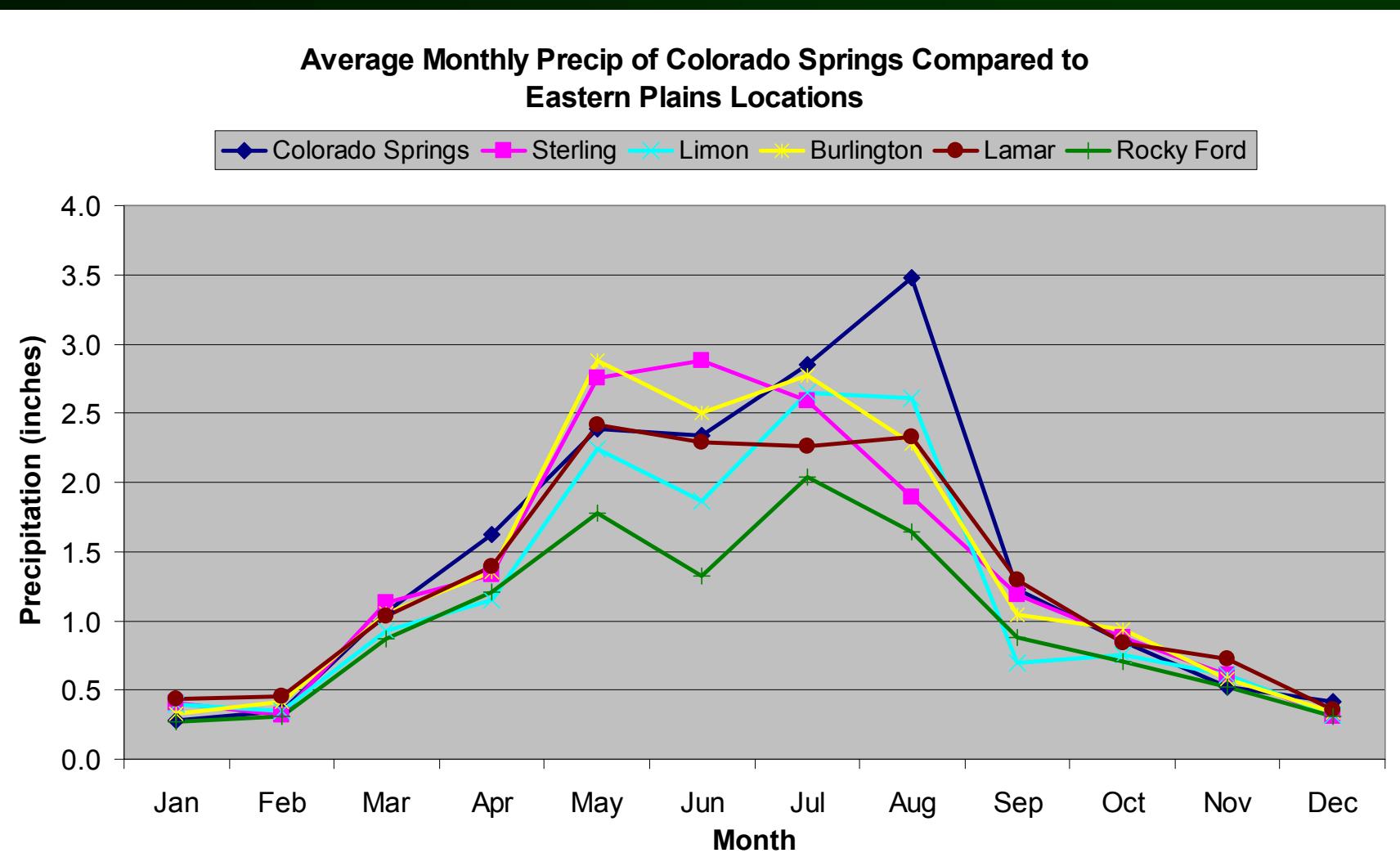
Average Monthly Precip of Colorado Springs Compared to Mountain Locations



Average Monthly Precipitation Compared to Other Front Range Cities



Average Monthly Precipitation Compared to Eastern Plains Locations



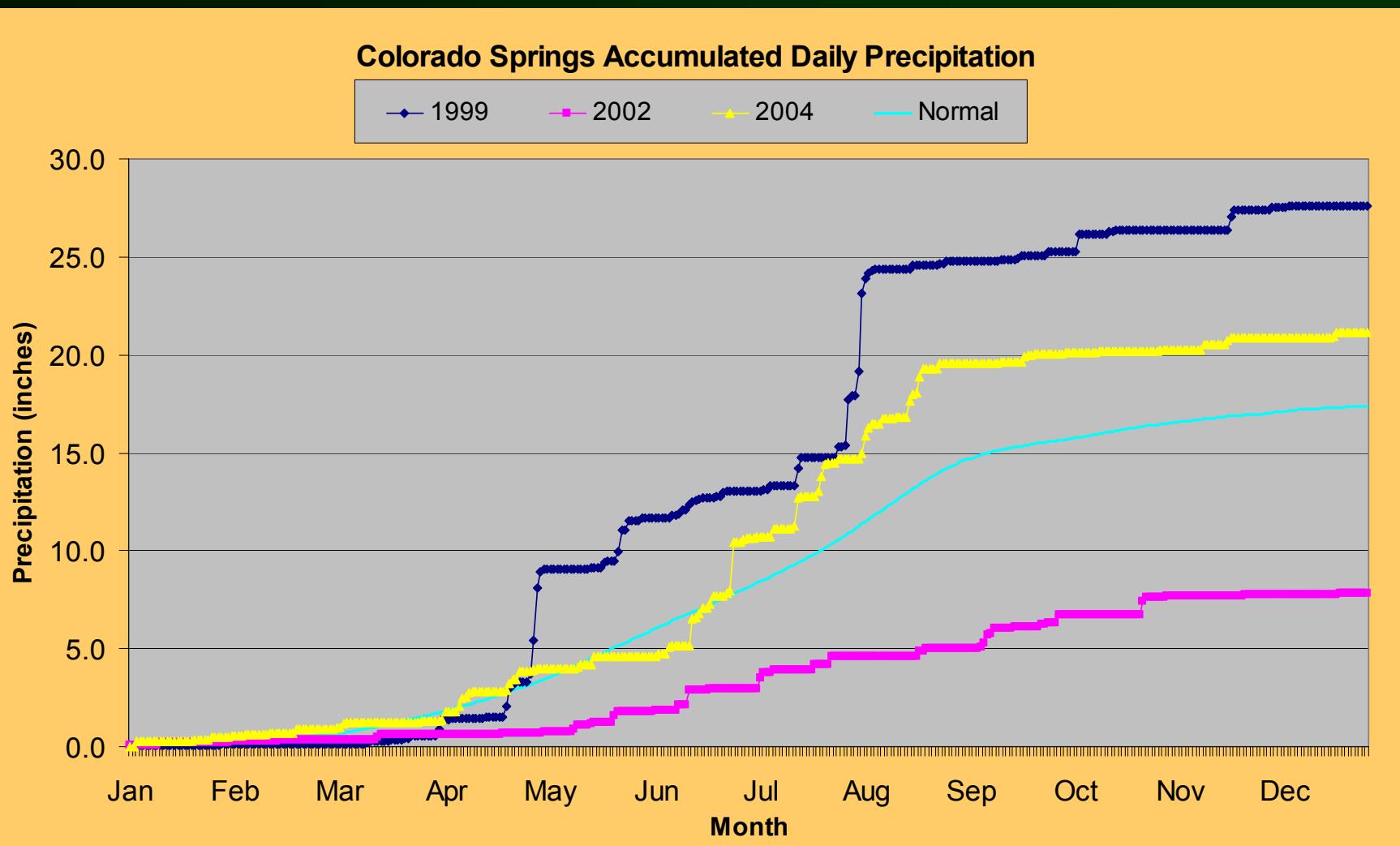
Comparing averages is instructive, but, are we ever average?



John Haynes Cheyenne Wells, CO 2002



Colorado Springs Daily Precipitation Accumulation for 1999, 2002, and 2004



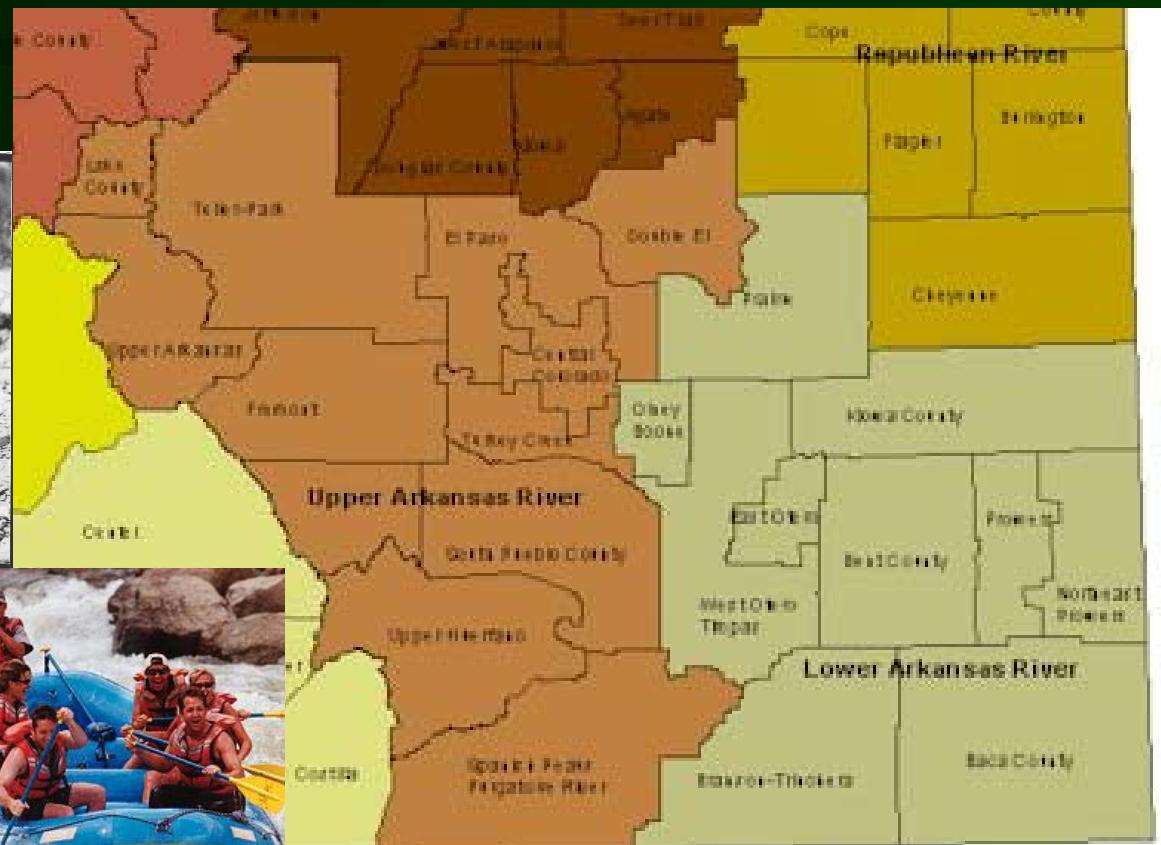
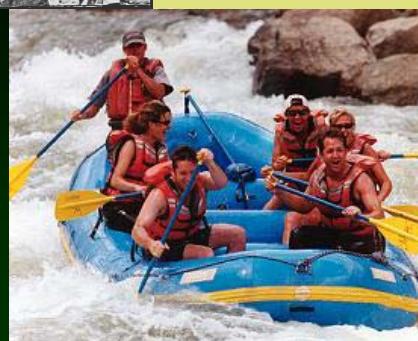
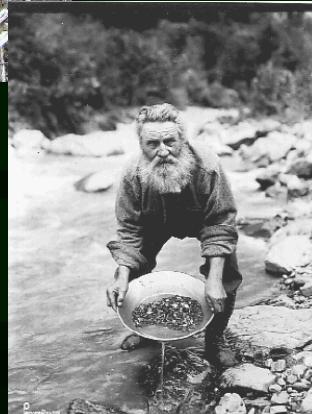
A Few Storms Contribute The Majority of Our Annual Precipitation

The difference between a very dry and very wet year is often just a few storms.

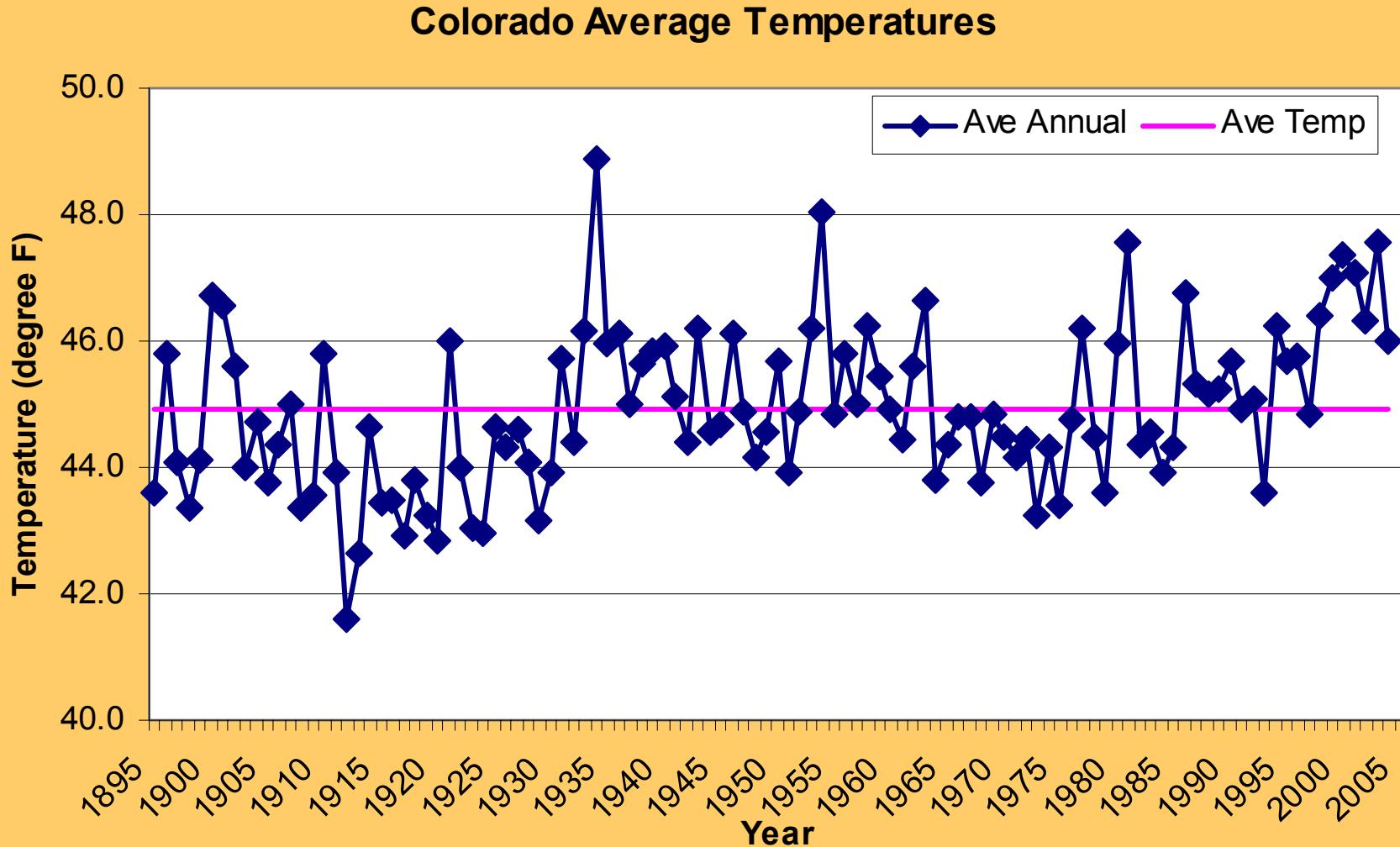


March 2003 Snowstorm in Fort Collins

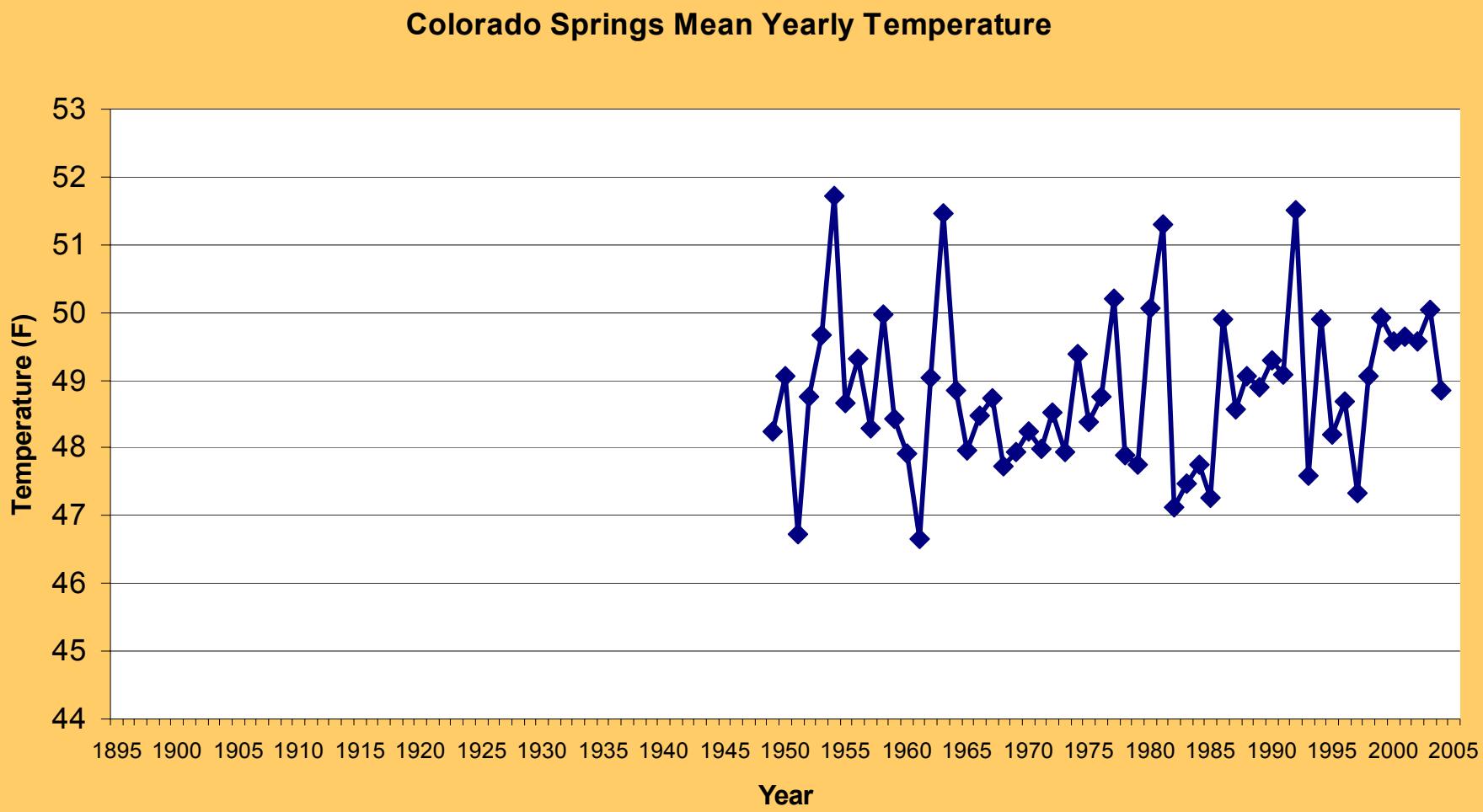
What Does History Show Us?



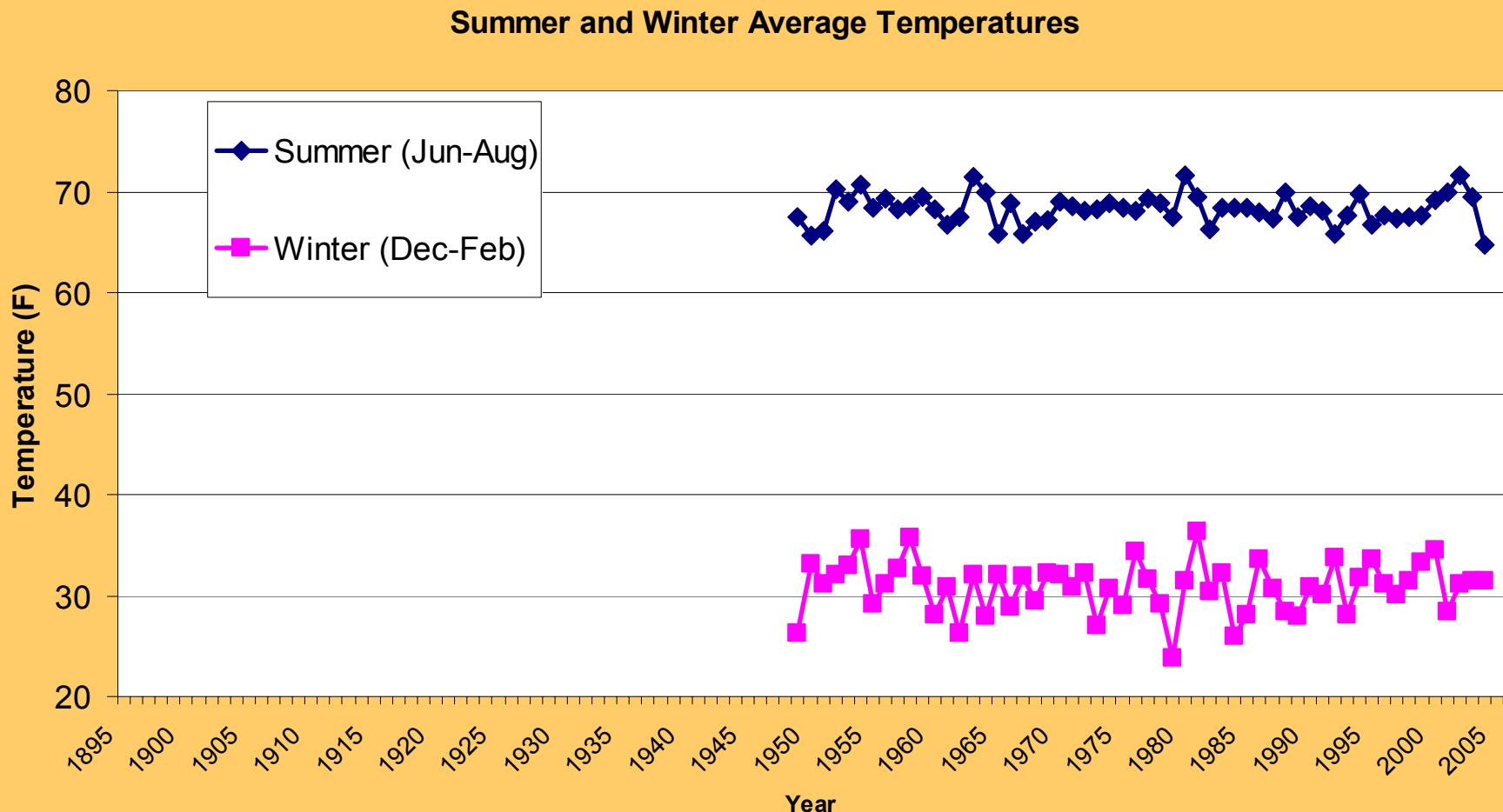
Statewide Mean Annual Temperature History



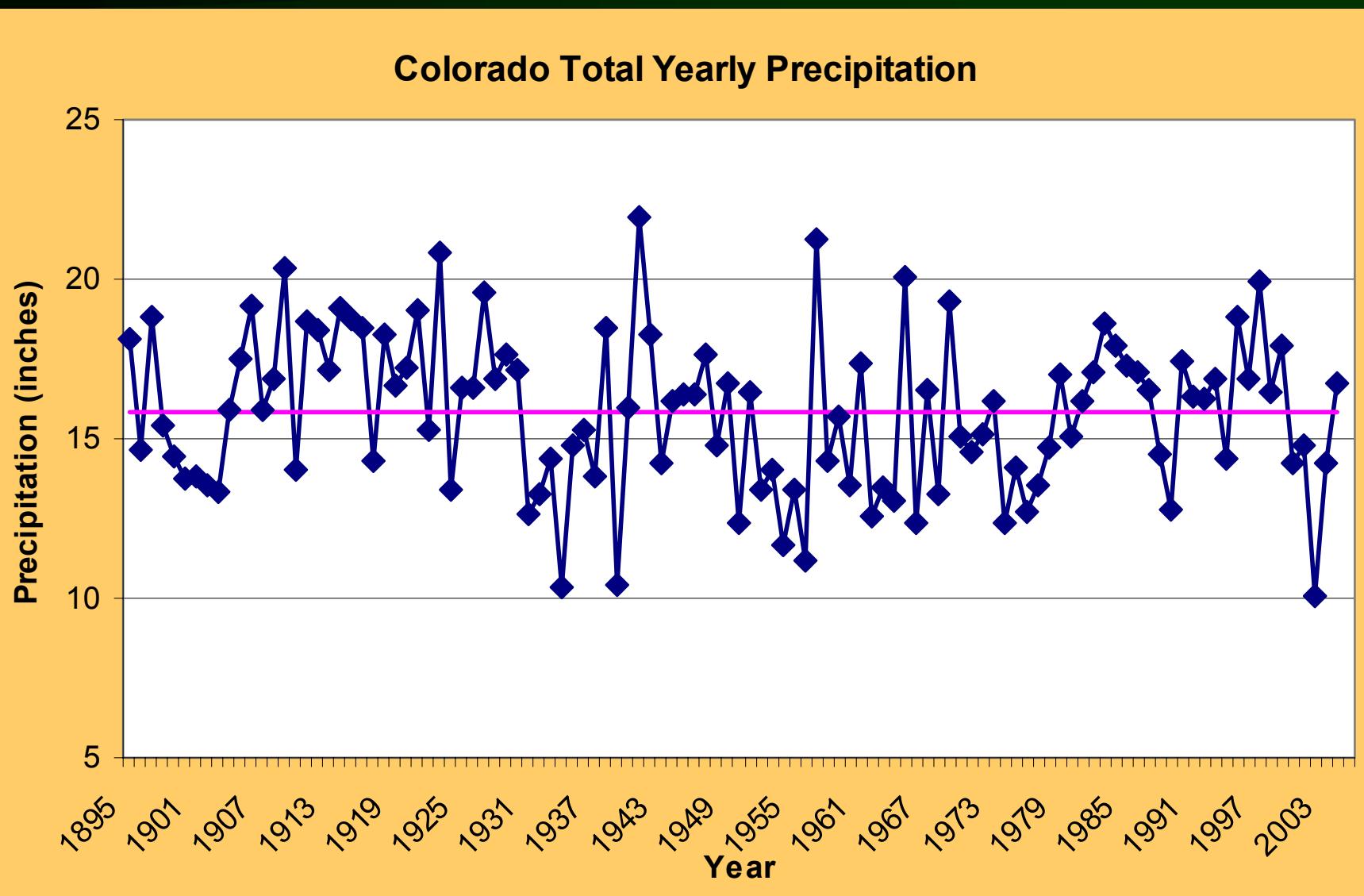
Colorado Springs Average Temperature History



Colorado Springs Summer and Winter Average Temperatures

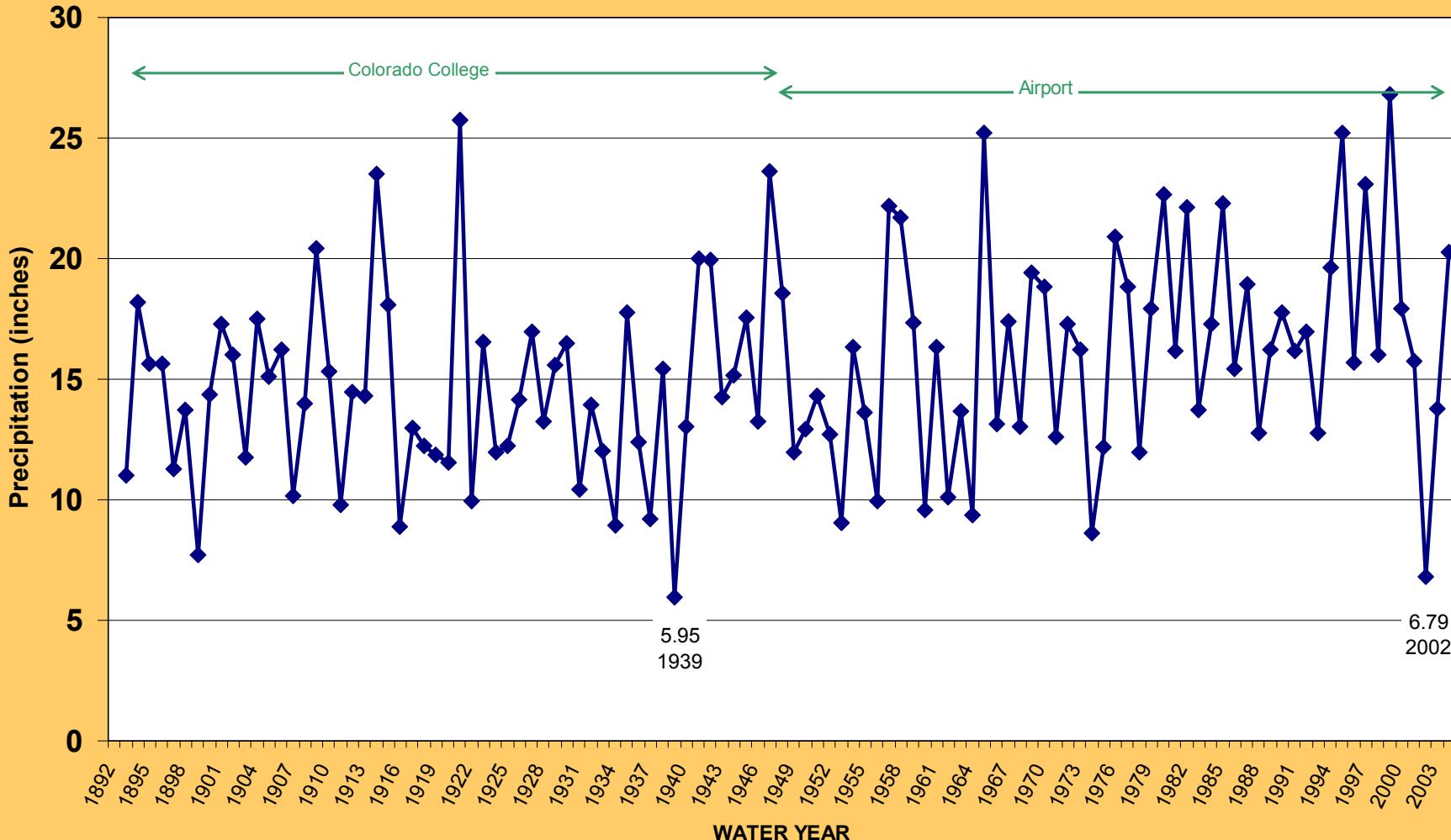


Statewide Annual Precipitation History

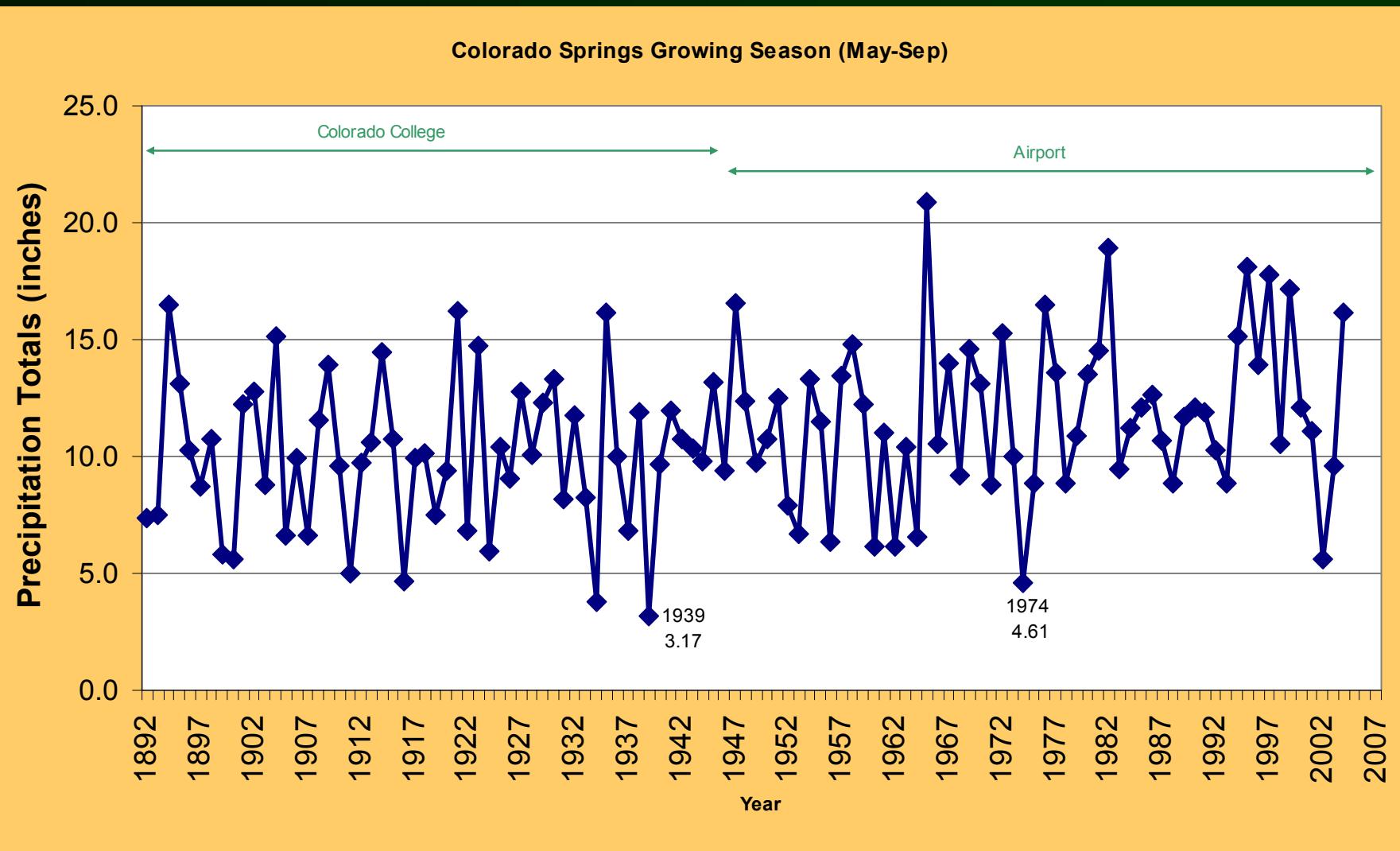


Colorado Springs Precipitation History

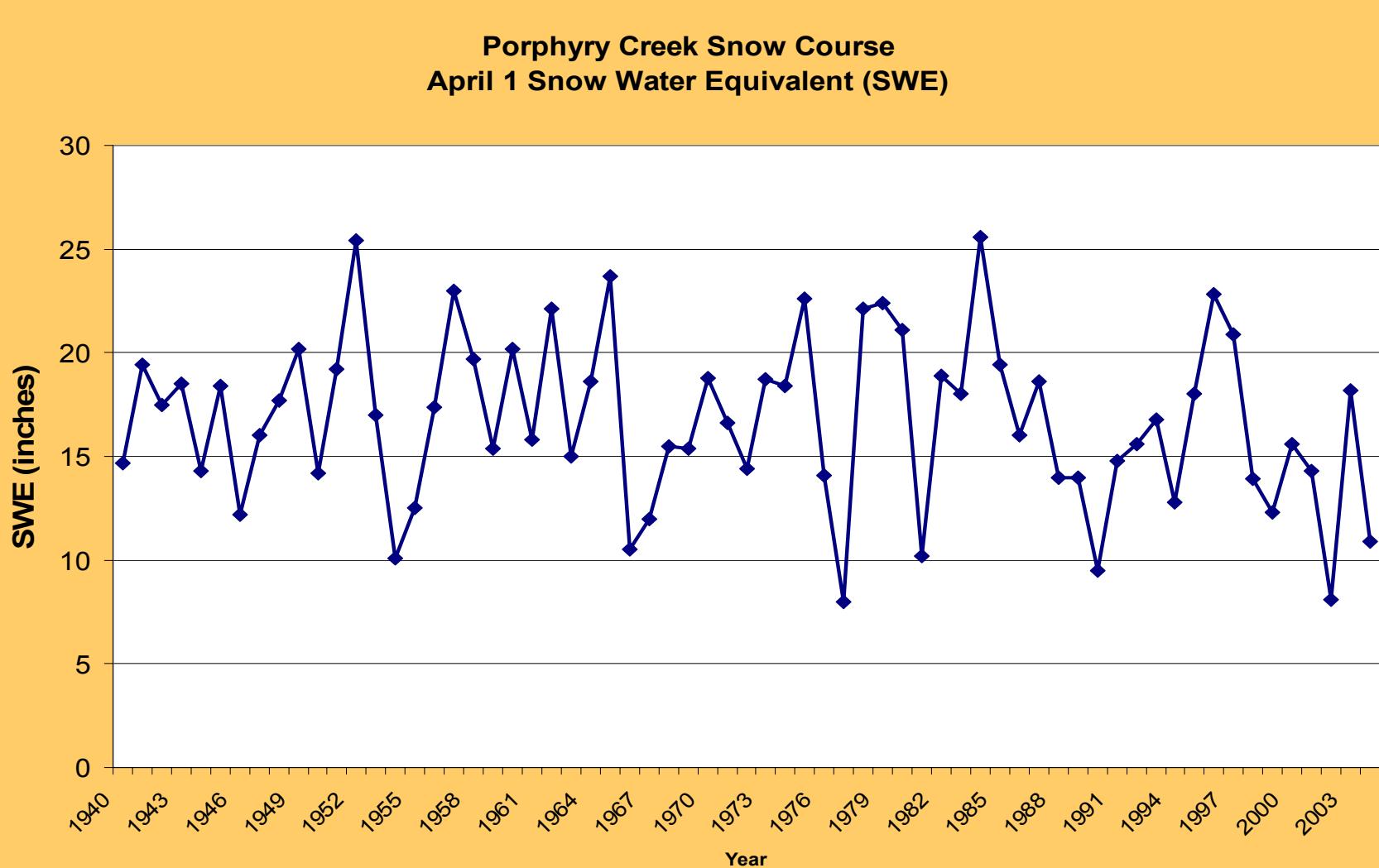
Colorado Springs Water Year Precipitation through 2004



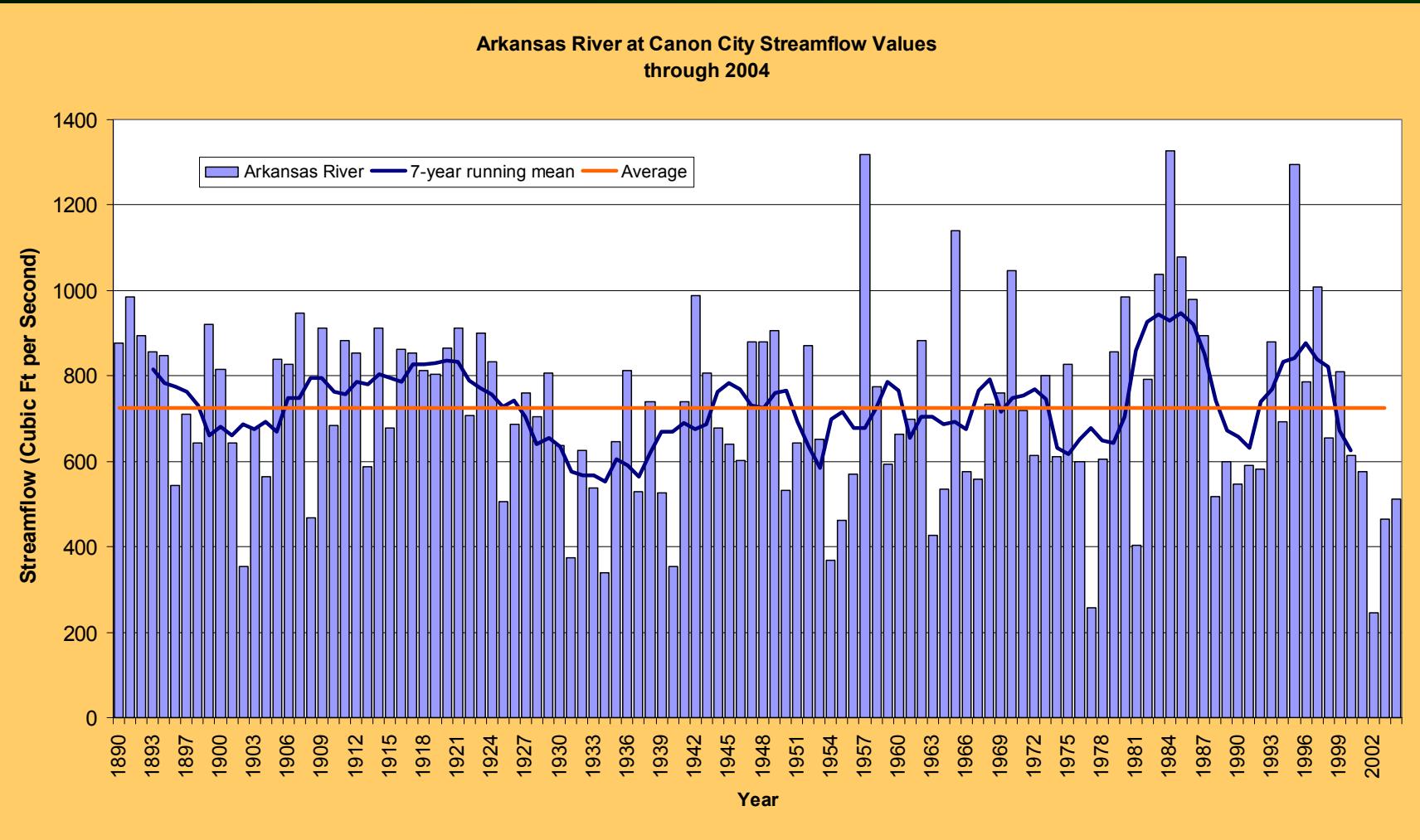
Colorado Springs Growing Season (May – Sep) Precipitation History



Porphyry Creek April 1 Snowpack History



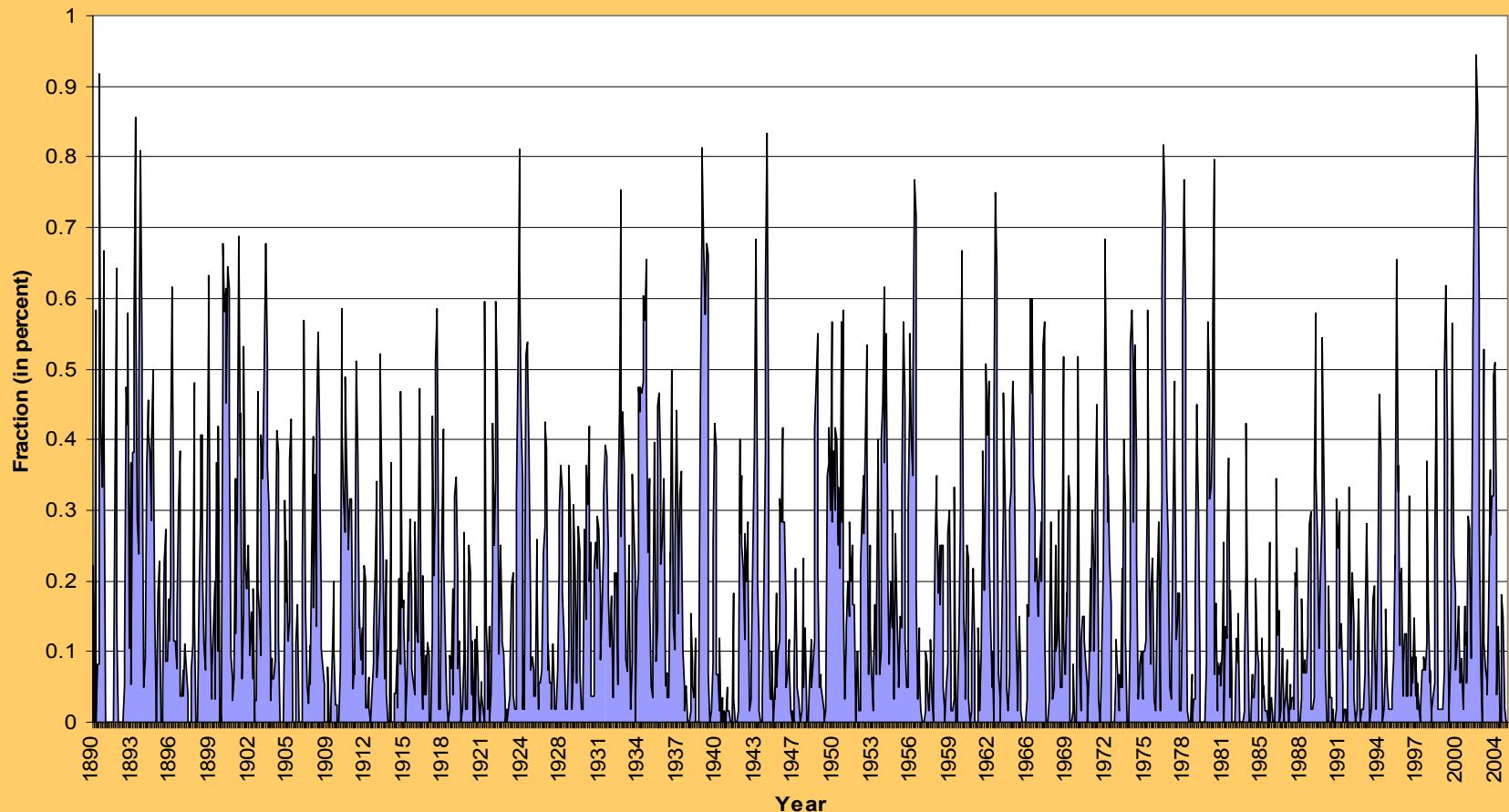
Arkansas River at Canon City Streamflow History



3-Month SPI

Fraction of Colorado in Drought Based on 3 month SPI

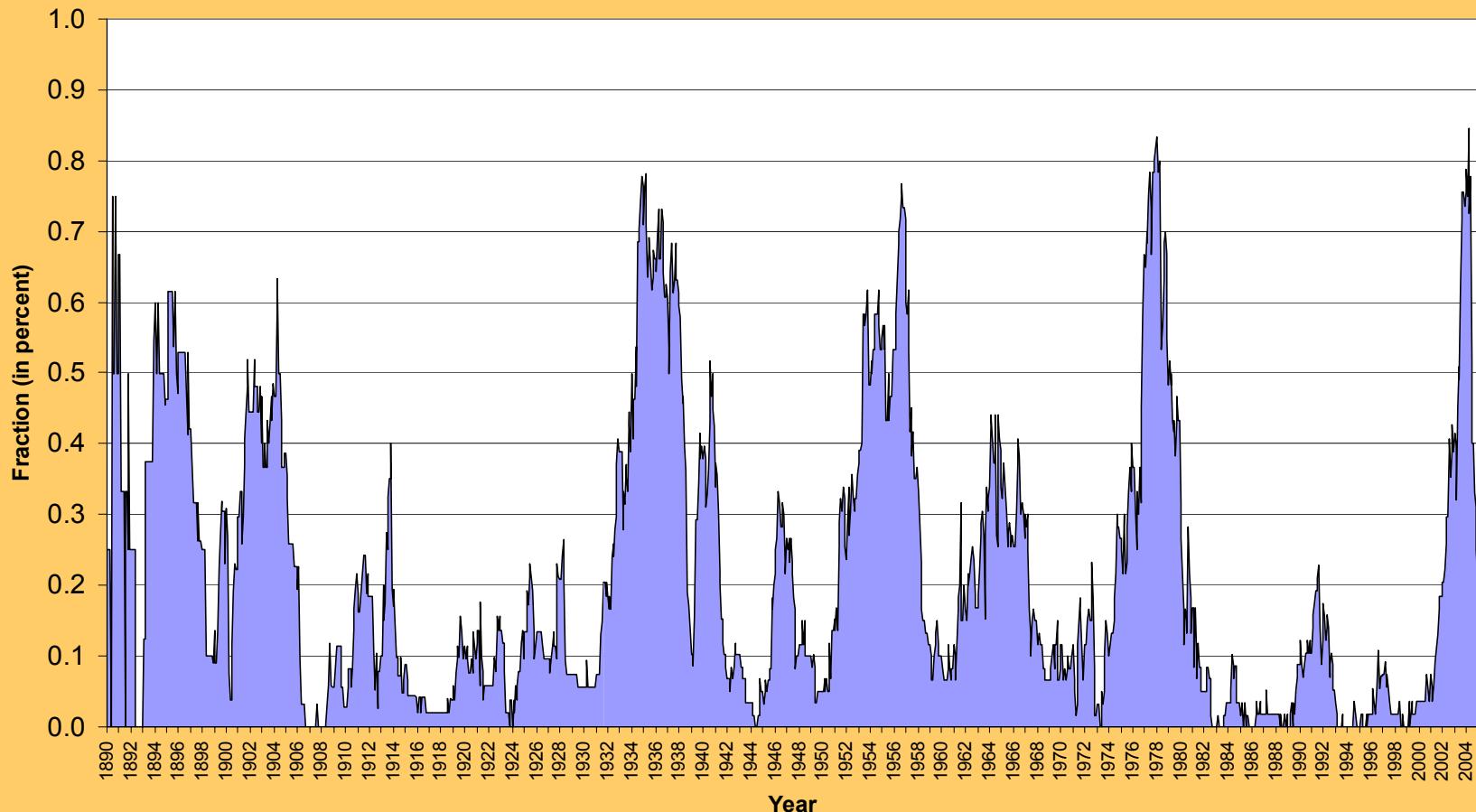
(1890 - 2004)



48-Month SPI

Fraction of Colorado in Drought Based on 48 month SPI

(1890 - 2004)

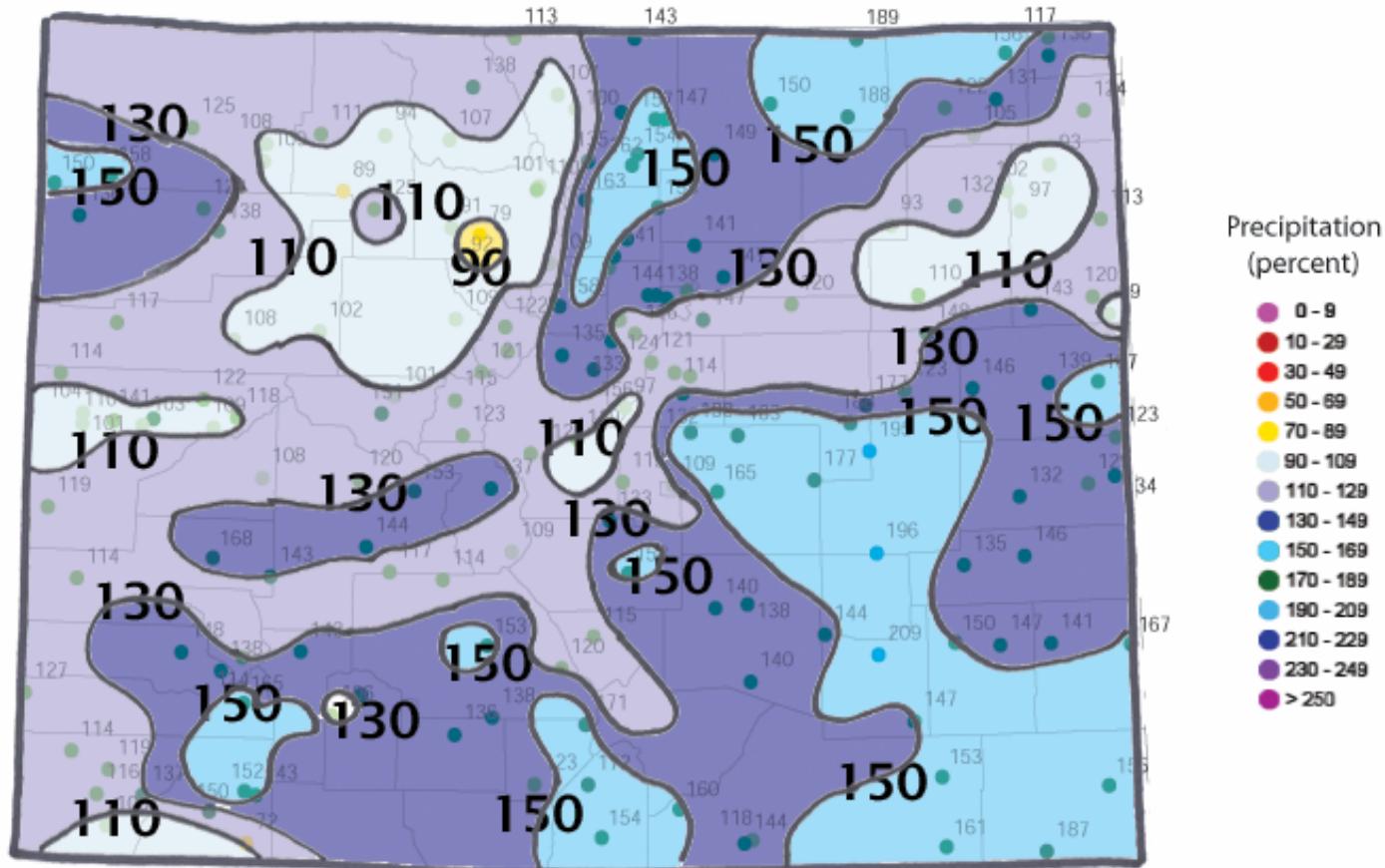


OK then – So what is the current status of Drought??



1999 Water Year Precipitation

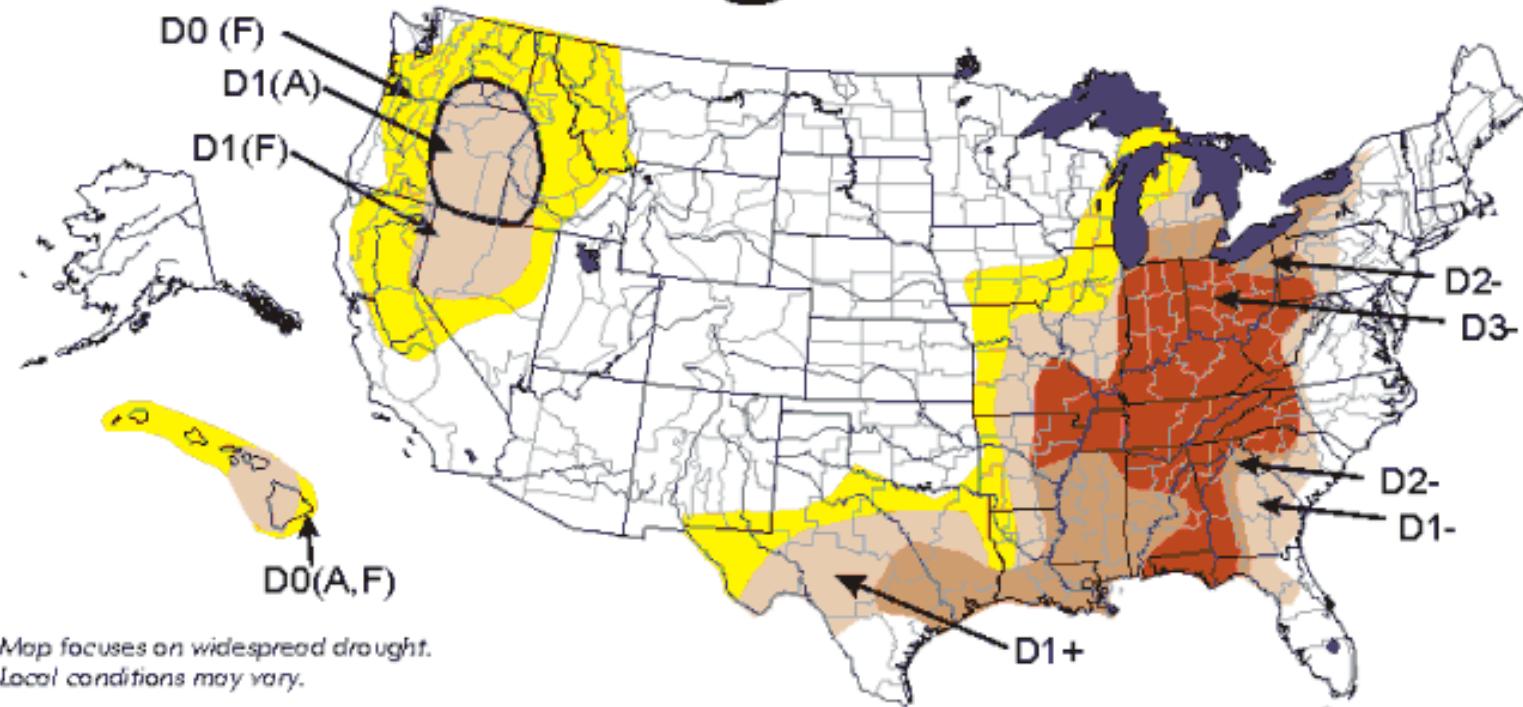
Water Year 1999
(Oct. 1998-Sept. 1999)
Precipitation Percent of Average for 1961-1990 Averages



September 1999 Drought Monitor Map

September 28, 1999

U.S. Drought Monitor



Map focuses on widespread drought.
Local conditions may vary.

- D0 Watch
- D1 Drought
- D2 Drought-Severe
- D3 Drought-Extreme
- D4 Drought-Exceptional
- Delineates Overlapping Areas

Drought type: used only
when impacts differ

A = Agriculture
W = Water
F = Forest fire danger



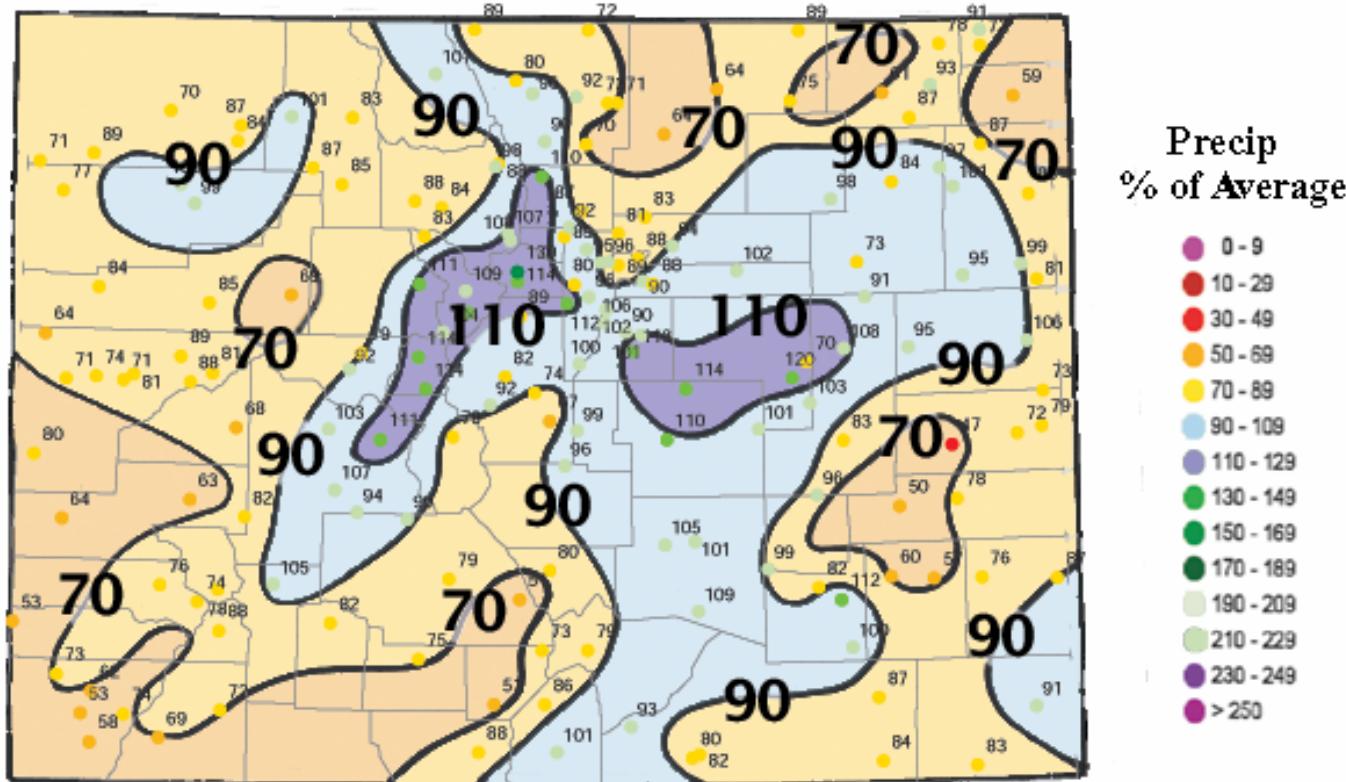
Plus (+) = Forecast to intensify next two weeks
Minus (-) = Forecast to diminish next two weeks
No sign = No change in drought classification forecast

• Released Thursday, Sep 30, 1999 •

2000 Water Year Precipitation

Water Year 2000
(Oct. 1999 - Sept. 2000)

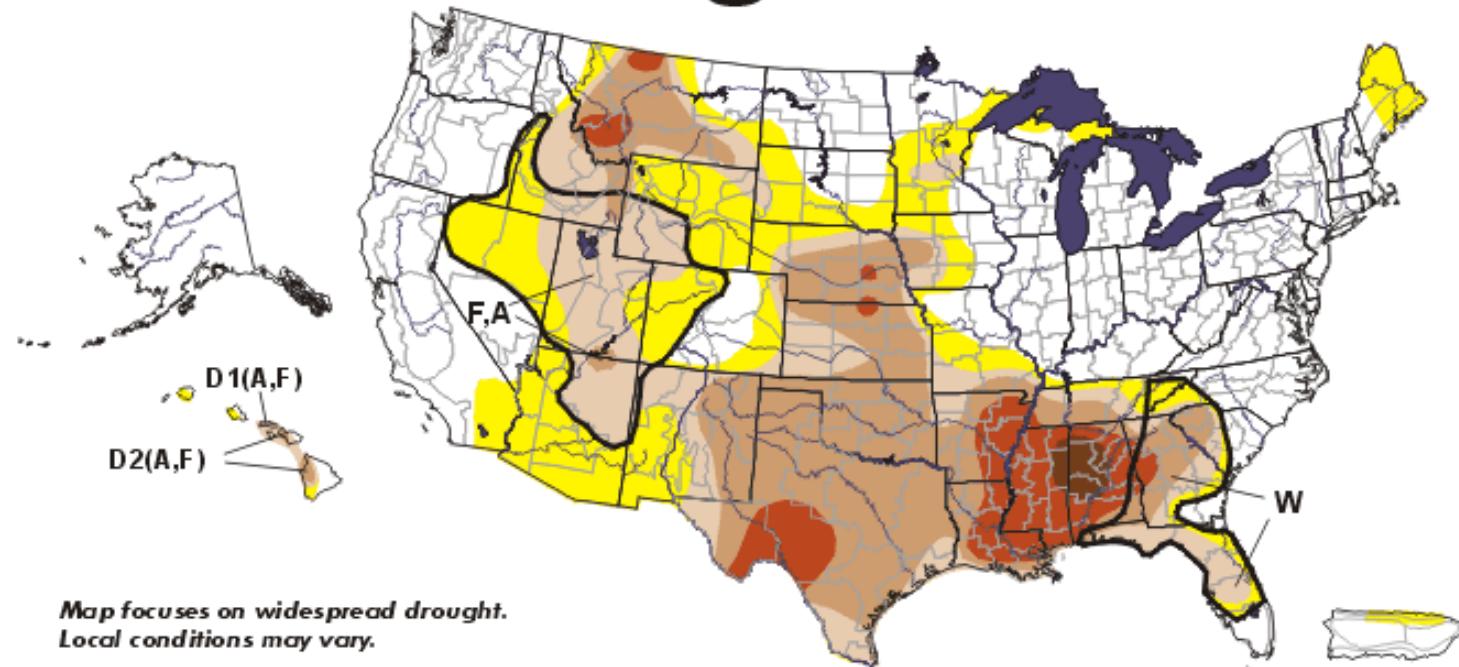
Precipitation Percent of Average for 1961-1990 Averages



October 2000 Drought Monitor Map

October 3, 2000 Valid 8 a.m. EDT

U.S. Drought Monitor



Map focuses on widespread drought.
Local conditions may vary.

- D0 Abnormally Dry
- D1 Drought-First Stage
- D2 Drought-Severe
- D3 Drought-Extreme
- D4 Drought-Exceptional
- Delineates Overlapping Areas

- Drought type: used only when impacts differ
- A = Agriculture
- W = Water
- F = Wildfire danger

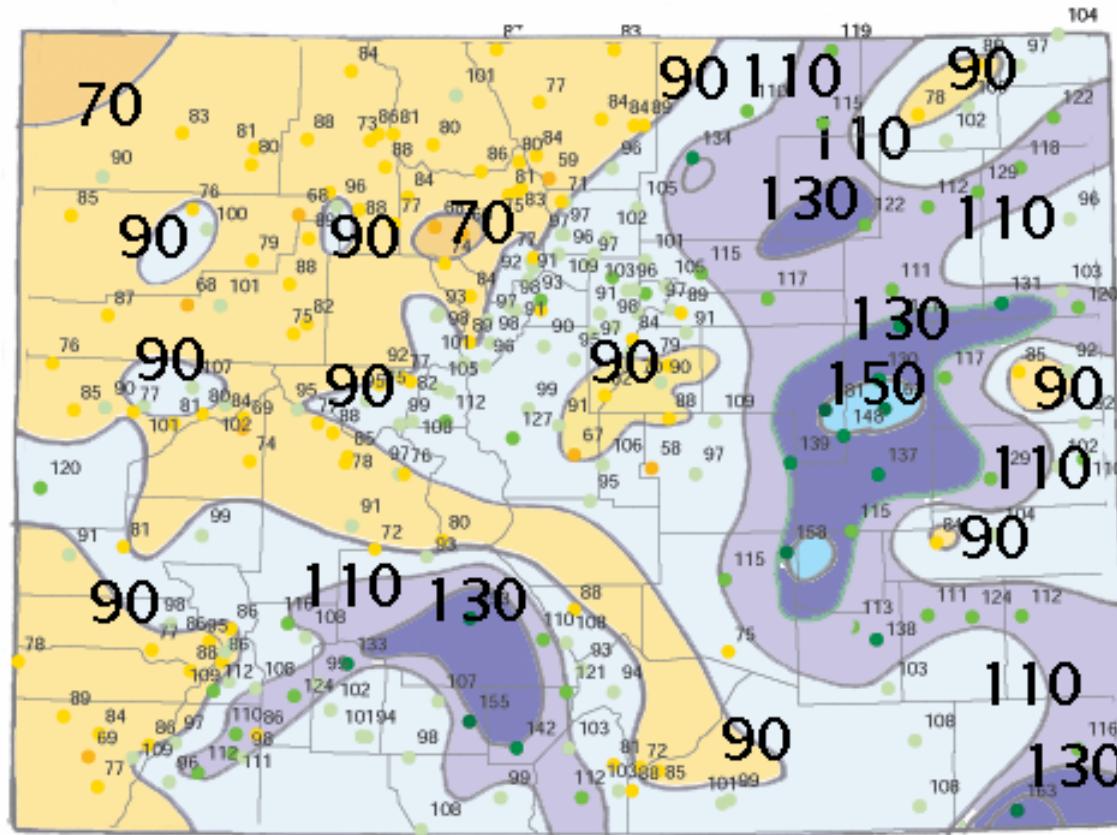
See accompanying text summary for forecast statements
<http://enso.unl.edu/monitor/monitor.html>



• Released Thursday, Oct. 5, 2000 •

2001 Water Year Precipitation

Water Year 2001
(Oct. 2000 - Sept. 2001)
Precipitation Percent of Average for 1961-1990 Averages



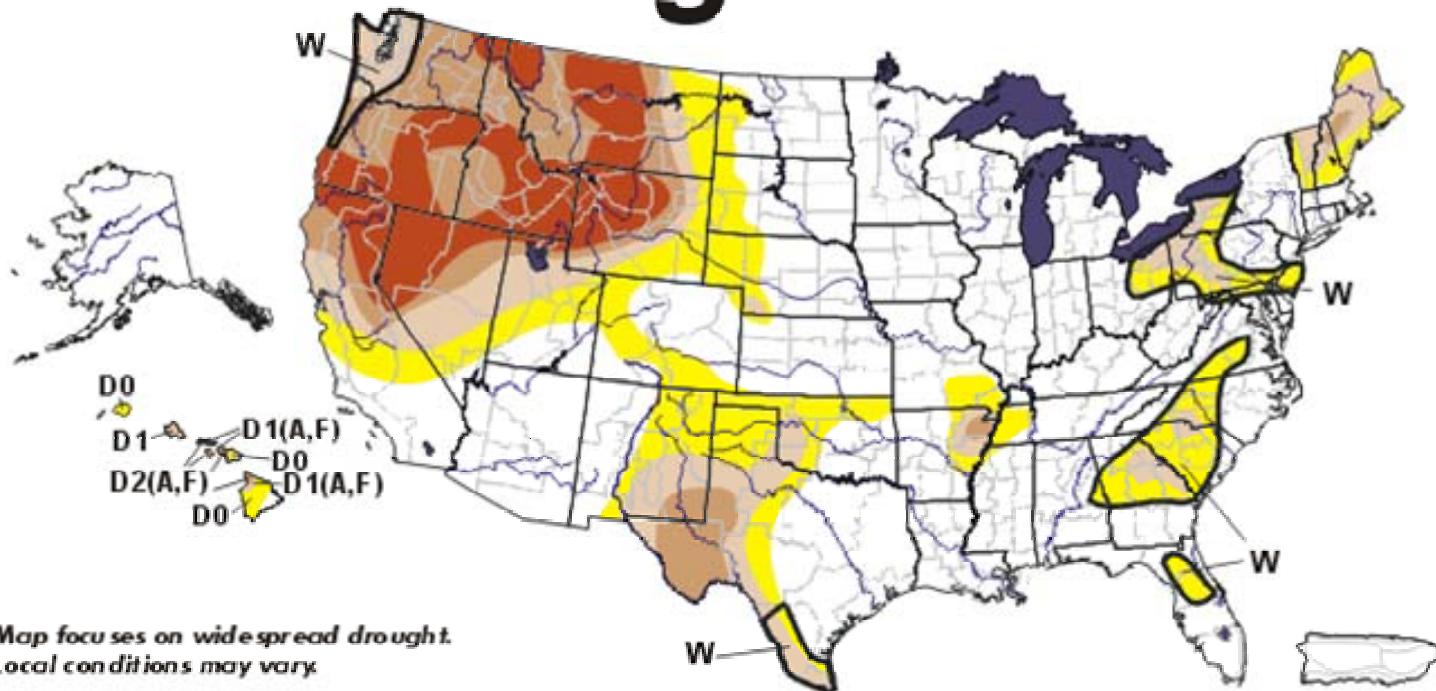
Precip
% of Average

- 0 - 9
- 10 - 29
- 30 - 49
- 50 - 89
- 70 - 89
- 90 - 109
- 110 - 129
- 130 - 149
- 150 - 169
- 170 - 189
- 190 - 209
- 210 - 229
- 230 - 249
- > 250

October 2001 Drought Monitor Map

October 2, 2001 Valid 8 a.m. EDT

U.S. Drought Monitor



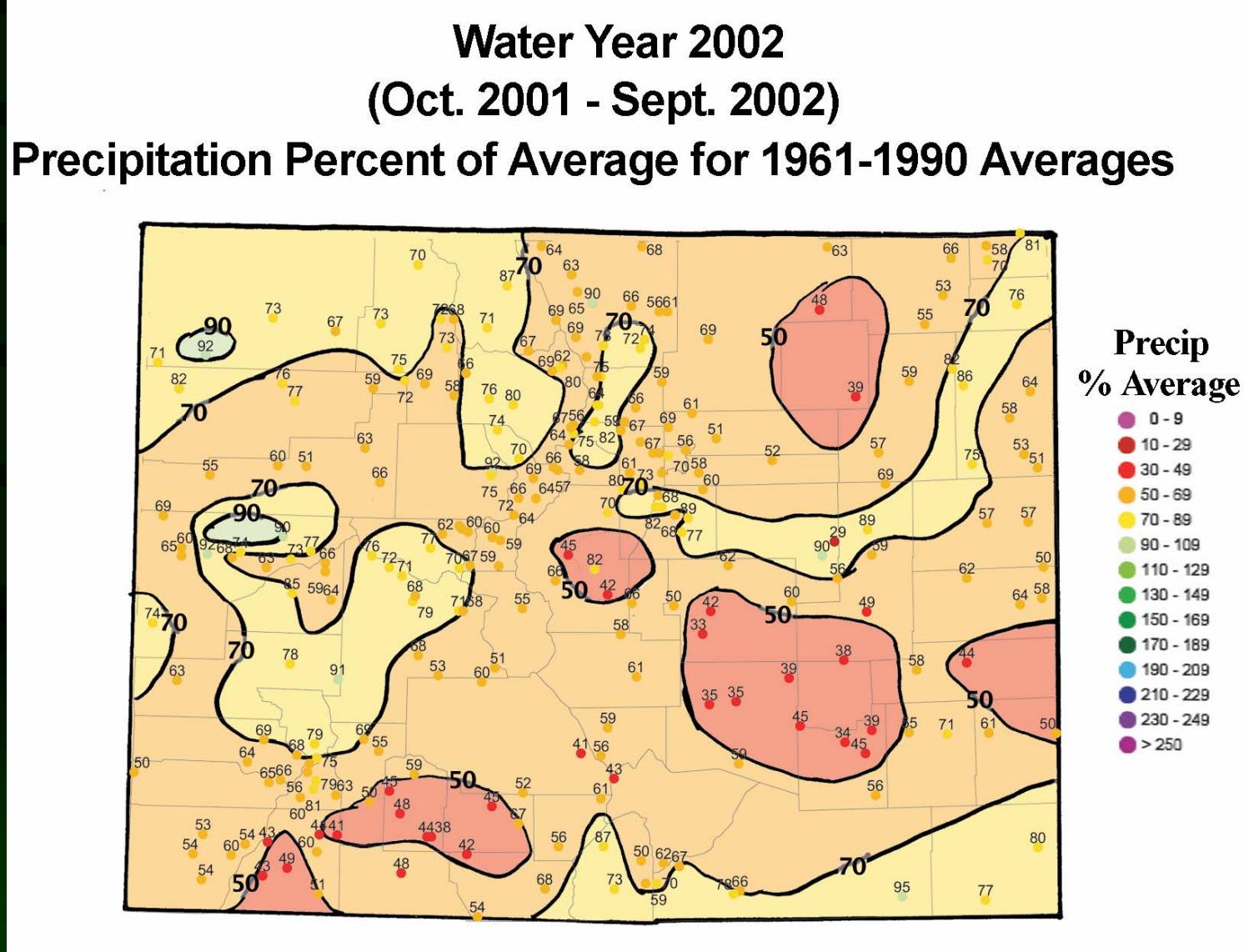
Drought Impact Types:
A = Agriculture
W = Water (Hydrological)
F = Fire danger (Wildfires)
(No type = All 3 impacts)



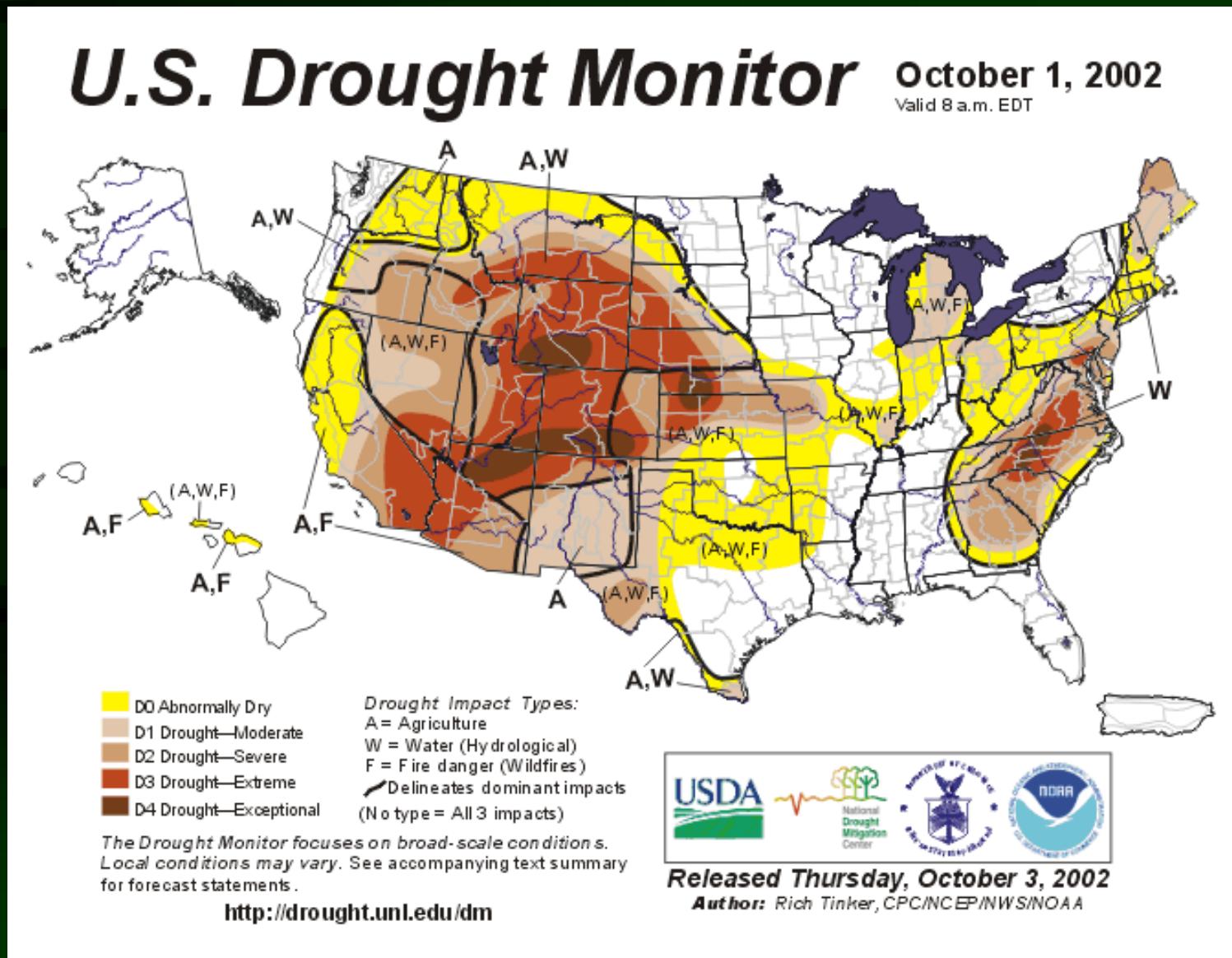
See accompanying text summary for forecast statements
<http://enso.unl.edu/monitor/monitor.html>

• Released Thursday, October 4, 2001 •
Author: Douglas Le Comte, NOAA/CPC

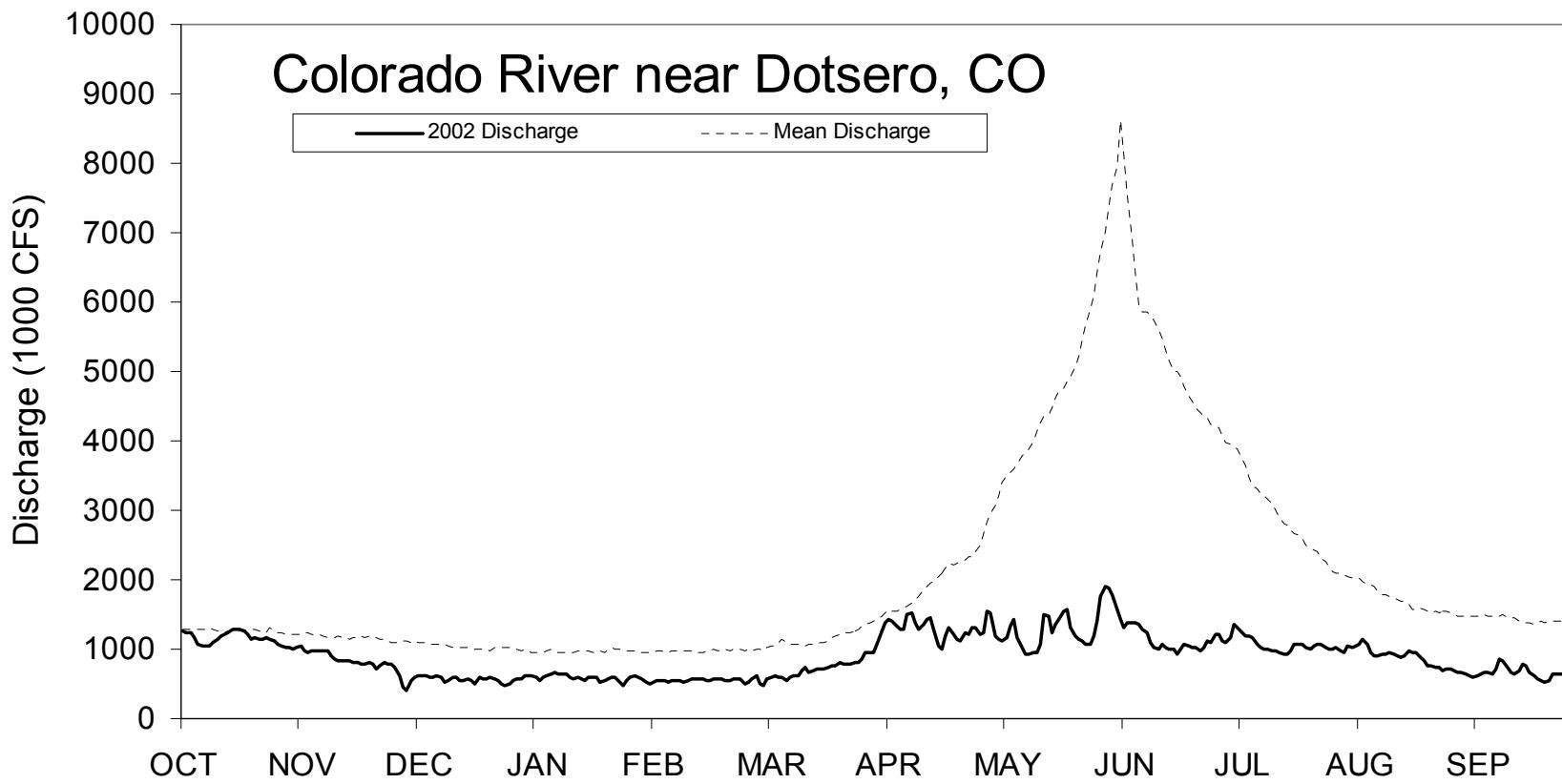
2002 Water Year Precipitation



October 2002 Drought Monitor Map



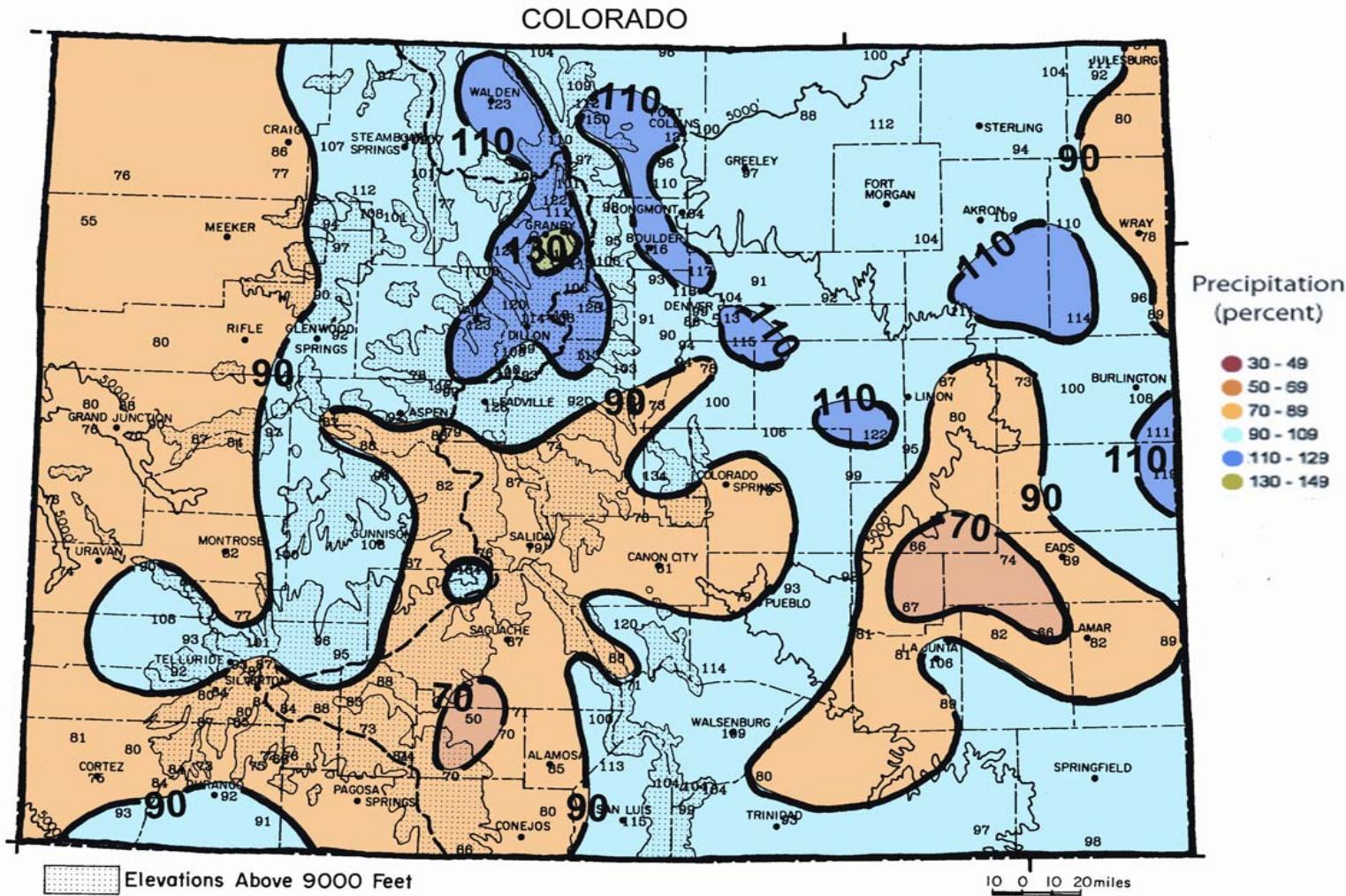
2002 Daily Streamflow



2003 Water Year Precipitation

Water Year 2003

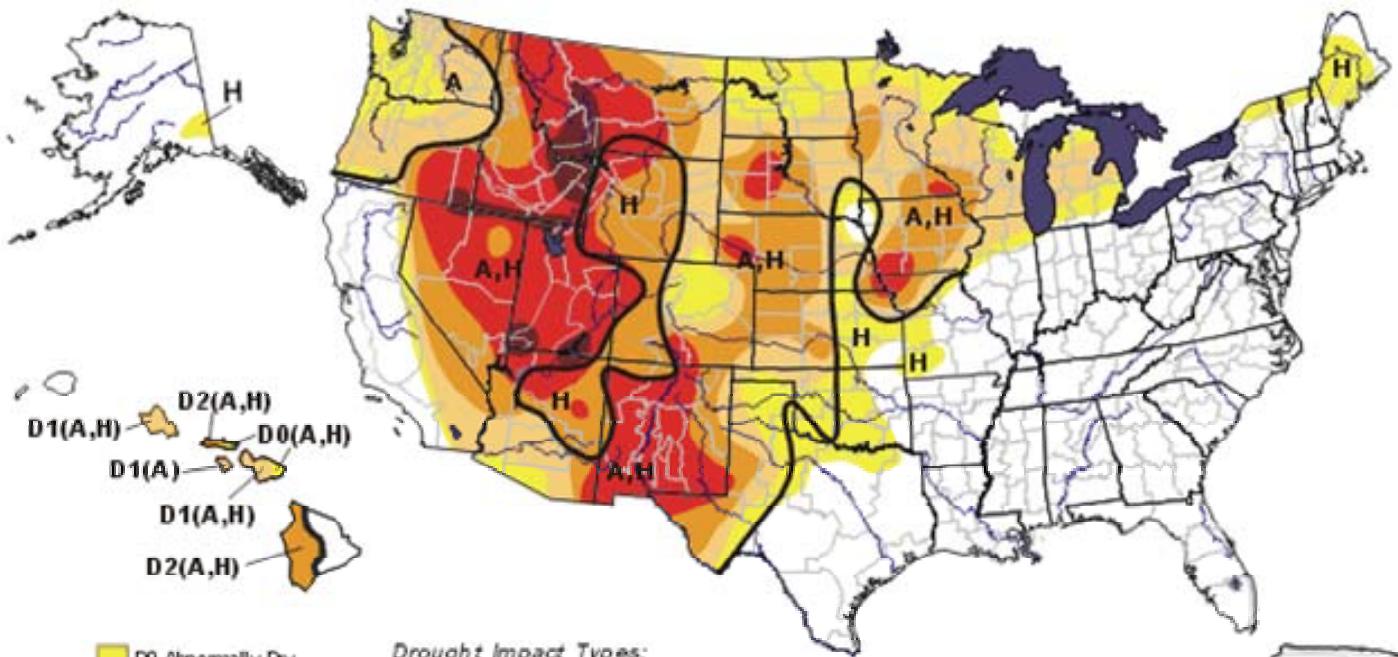
October 2002 - September 2003 precipitation
as a percent of the 1971-2000 average.



September 2003 Drought Monitor Map

U.S. Drought Monitor

September 30, 2003
Valid 8 a.m. EDT



- D0 Abnormally Dry
- D1 Drought—Moderate
- D2 Drought—Severe
- D3 Drought—Extreme
- D4 Drought—Exceptional

Drought Impact Types:
A= Agricultural (crops, pastures,
grasslands)
H= Hydrological (water)
No type = both impacts

✓ Delineates dominant impacts

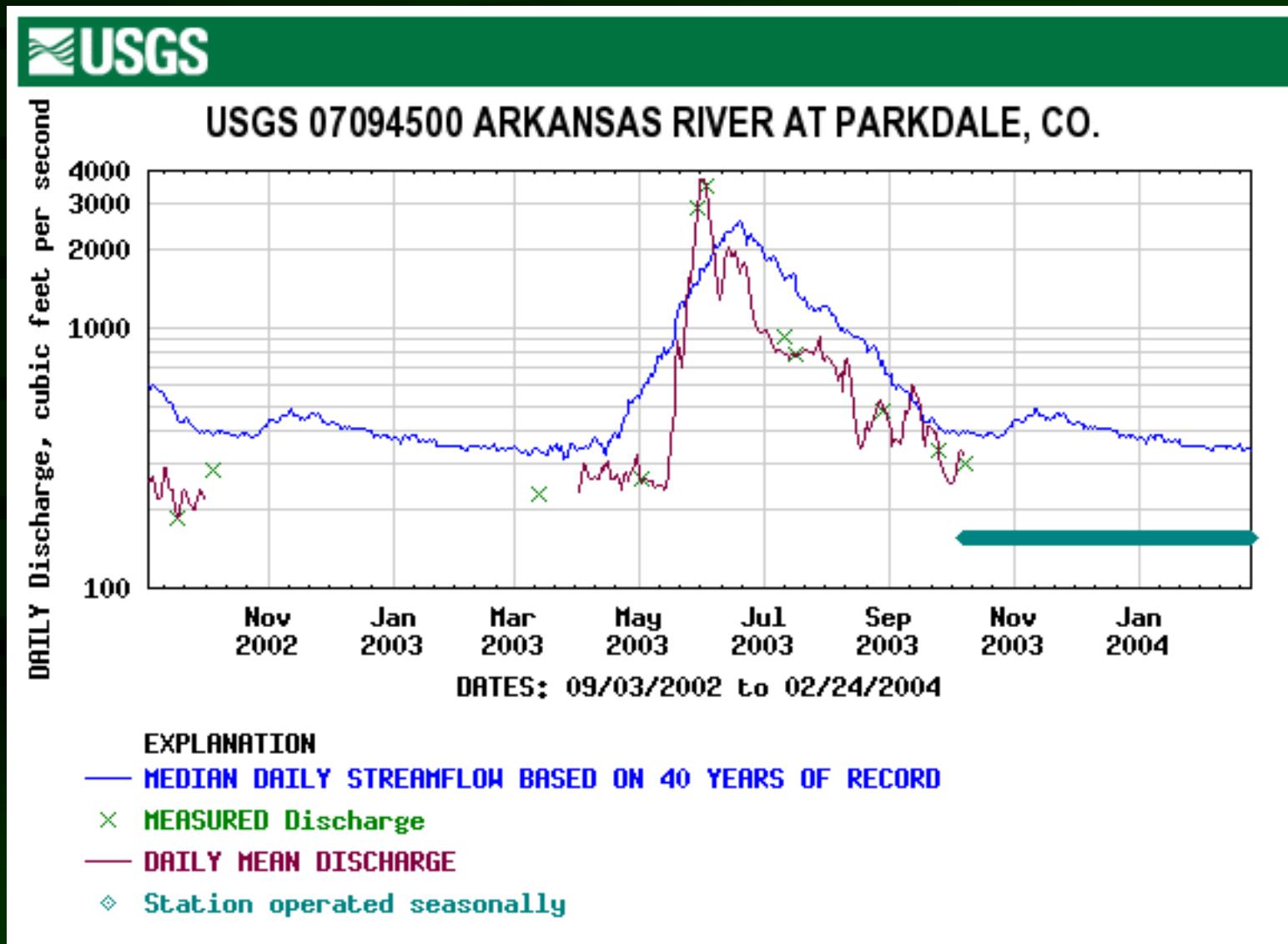
The Drought Monitor focuses on broad-scale conditions.
Local conditions may vary. See accompanying text summary
for forecast statements.

<http://drought.unl.edu/dm>



Released Thursday, October 2, 2003
Author: Candace Tankersley/Scott Stephens, NOAA/NCDC

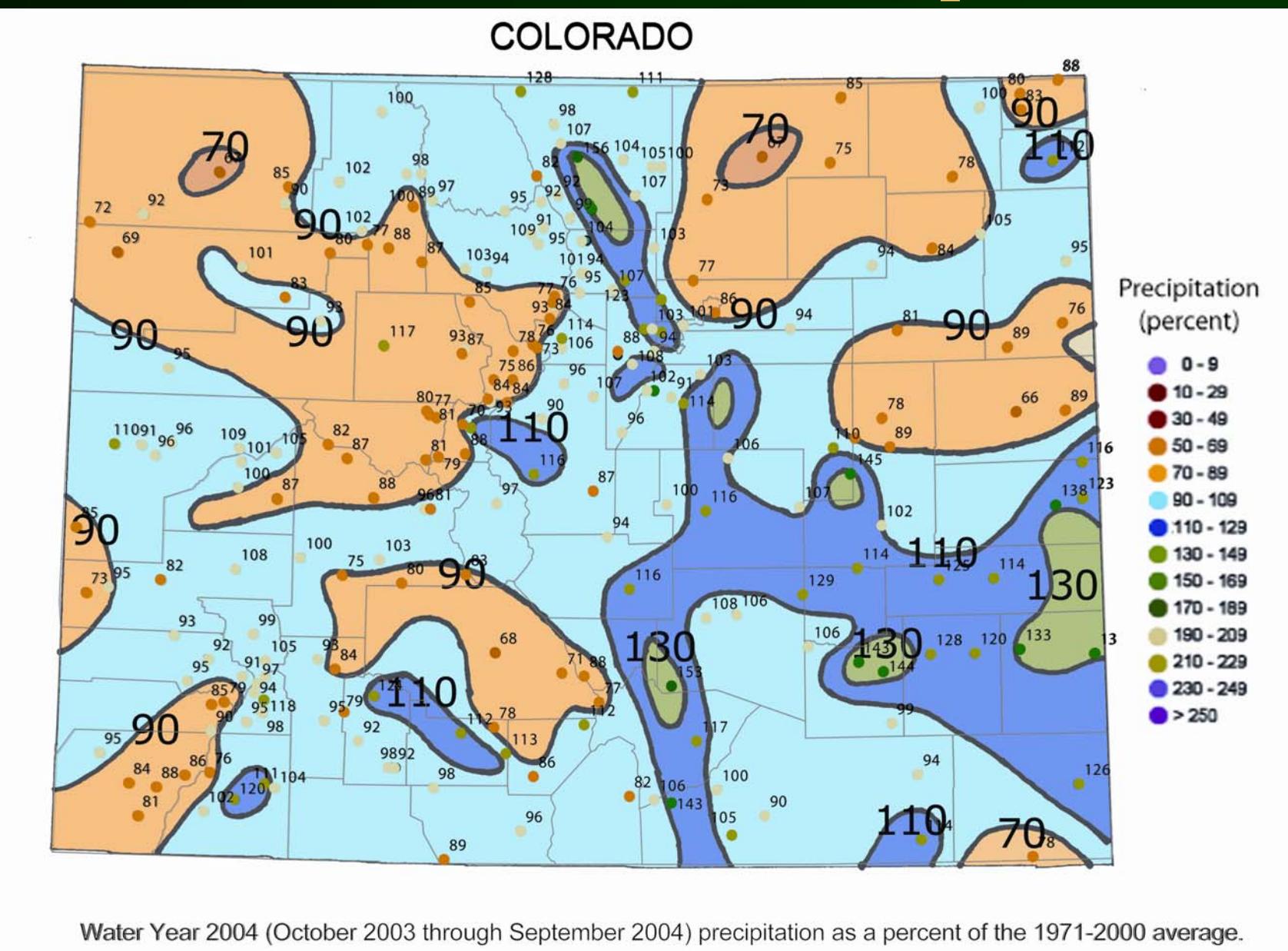
2003 Daily Streamflow



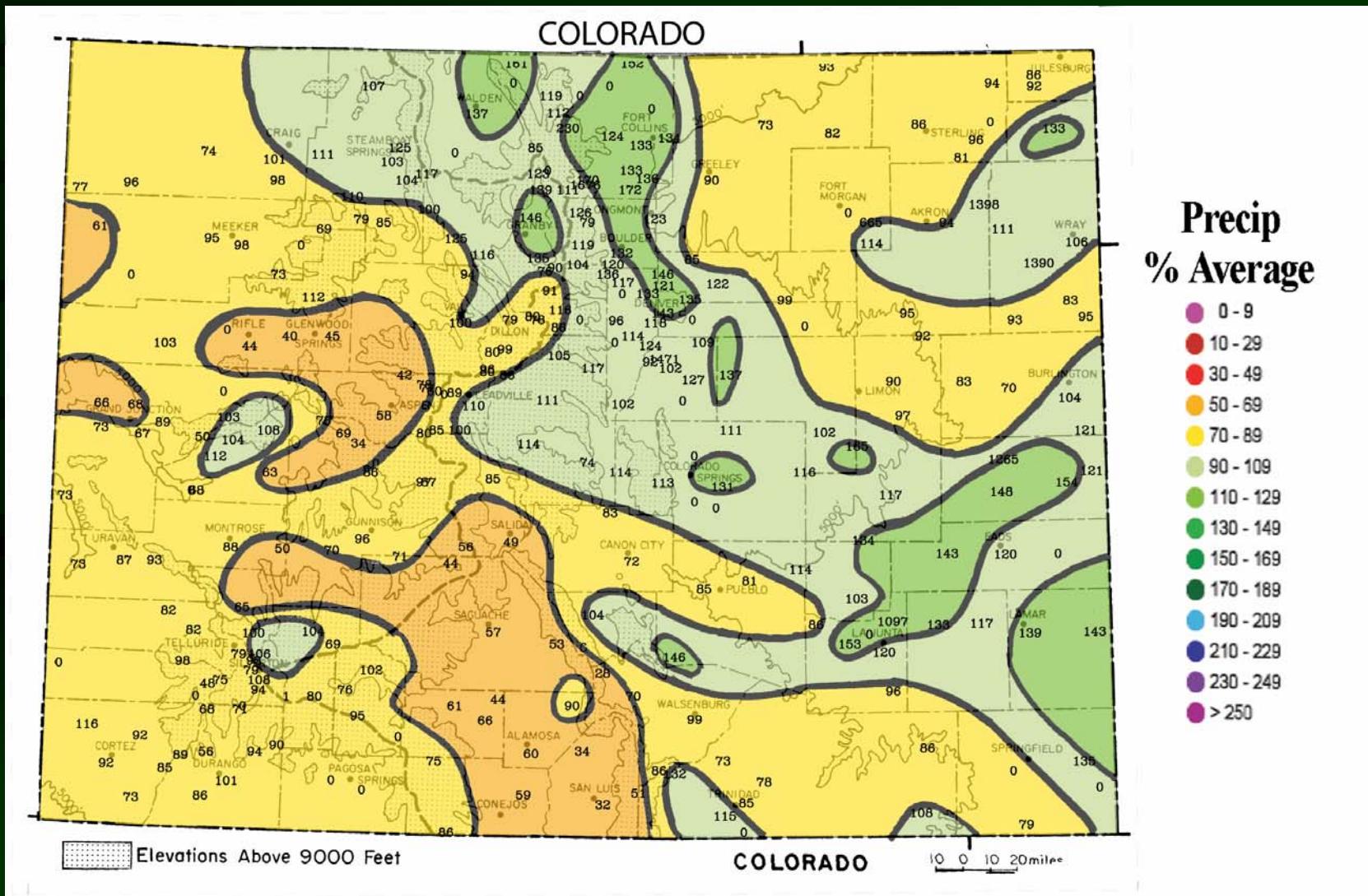
Where Do We Stand Now?



2004 Water Year Precipitation

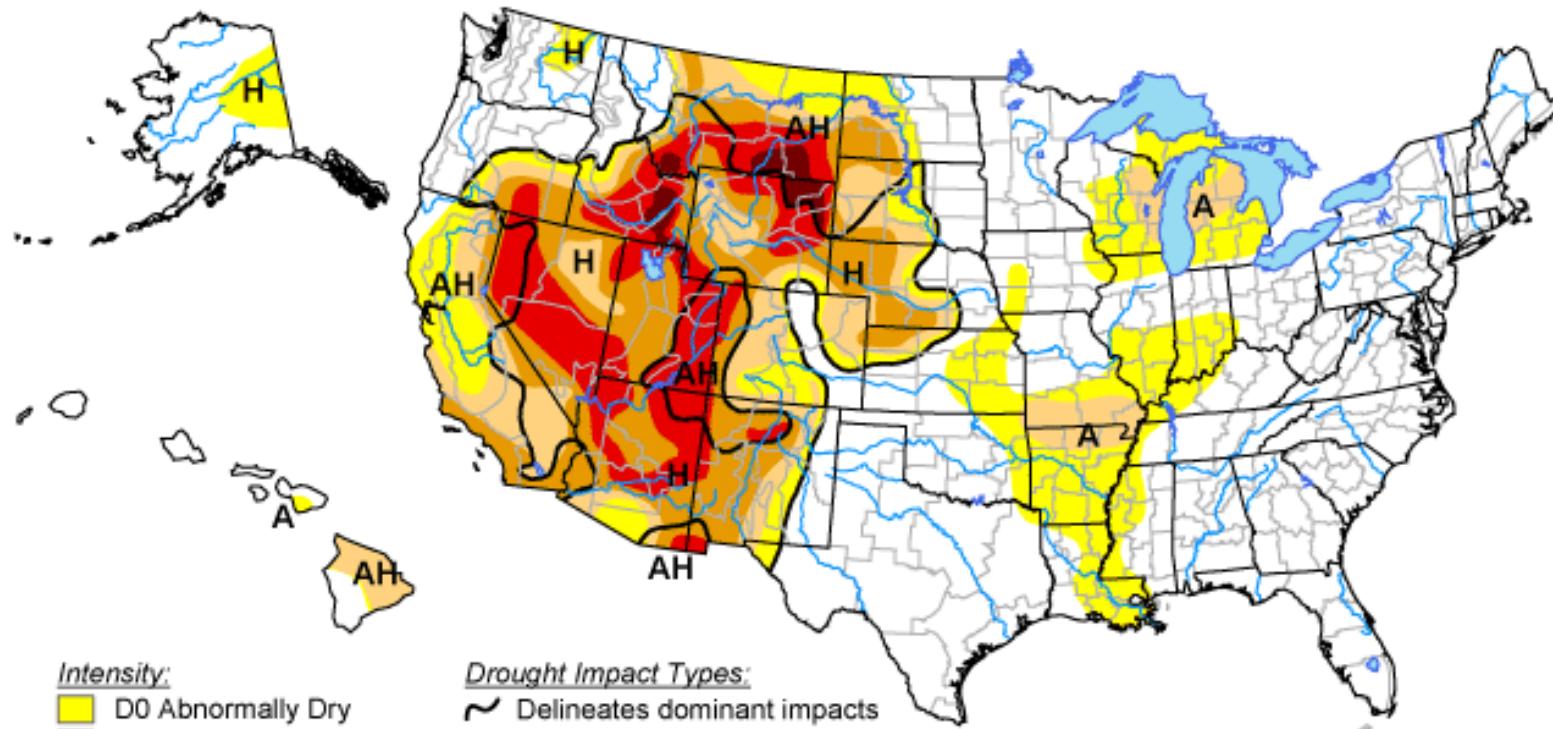


Growing Season (May-Sep) 2004 Precipitation as Percent of Average



U.S. Drought Monitor

October 5, 2004
Valid 8 a.m. EDT



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

- ~ Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)
- (No type) = Both impacts

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

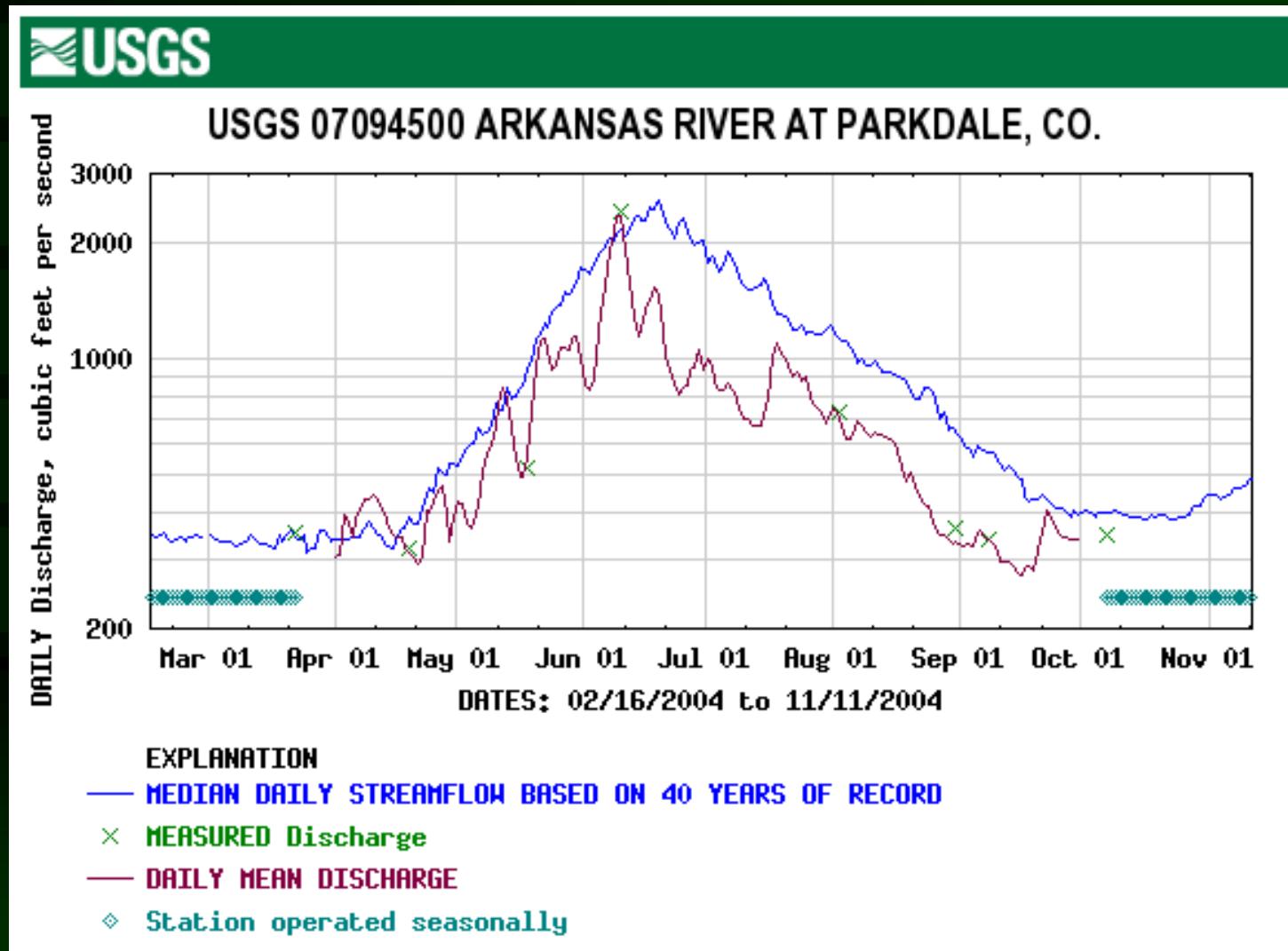
<http://drought.unl.edu/dm>



Released Thursday, October 7, 2004

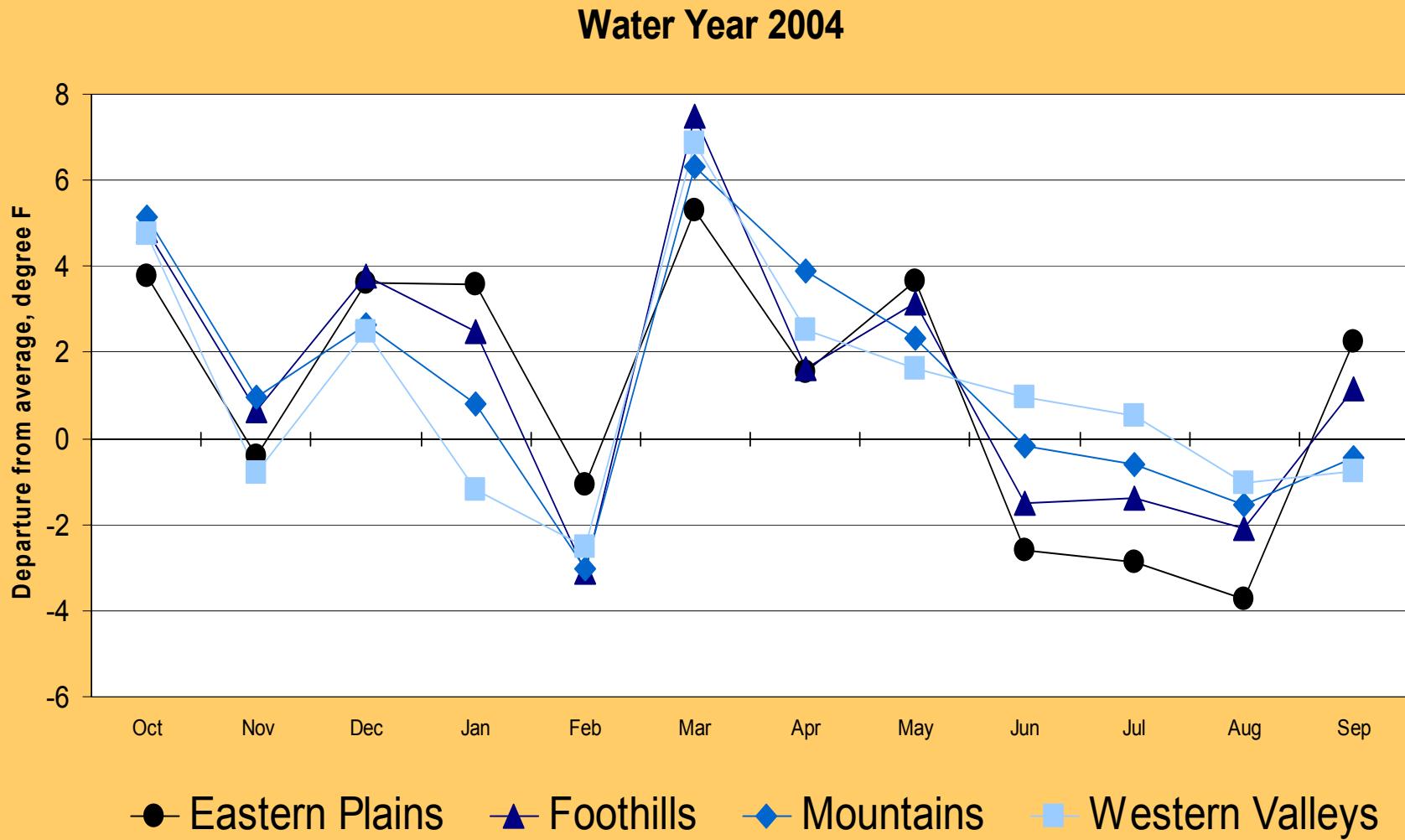
Author: Michael Hayes, NDMC

2004 Daily Streamflow

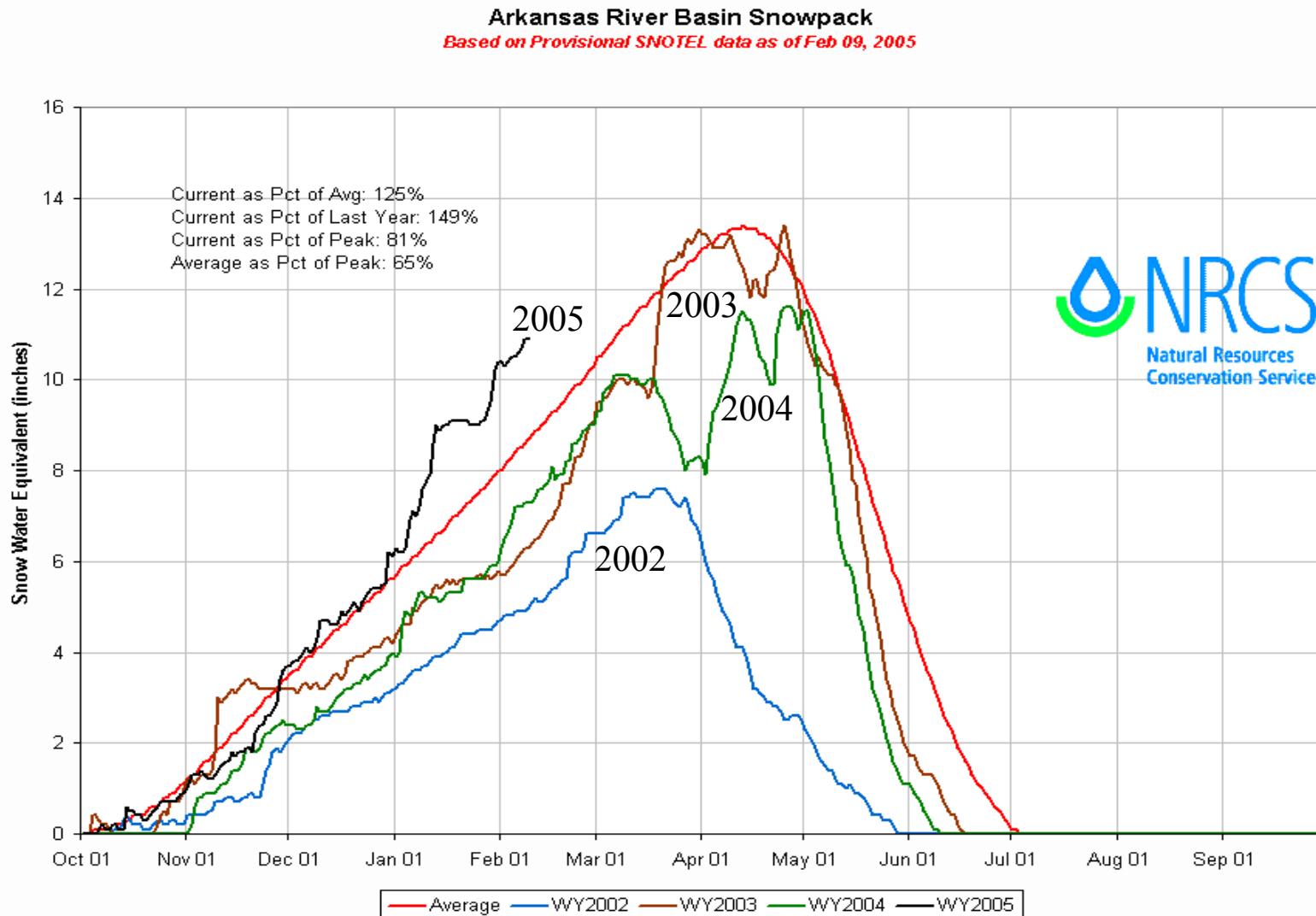


http://water.usgs.gov/cgi-bin/daily_flow?co

WY2004 Temperature Departures

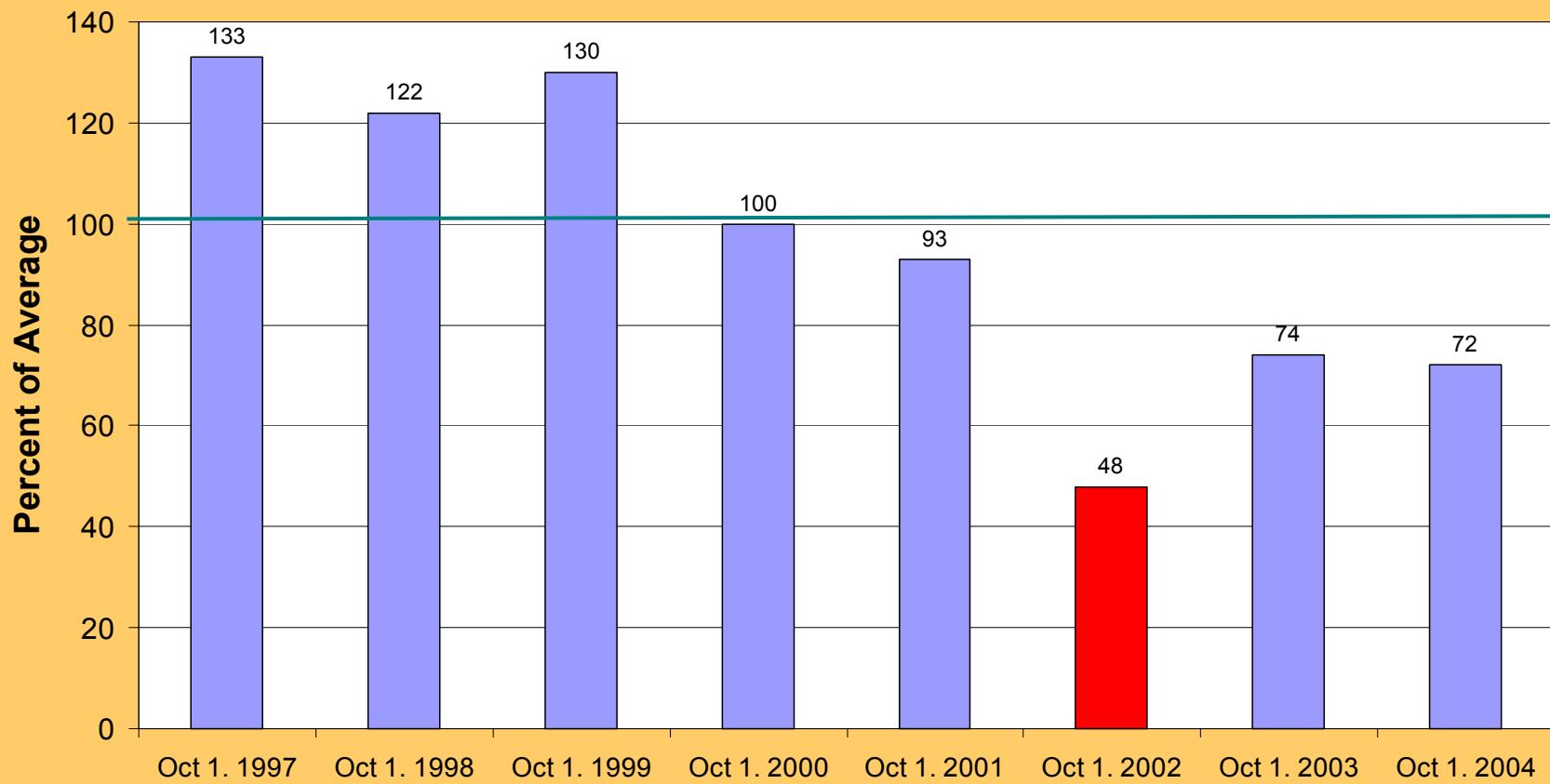


Arkansas Basin Snowpack



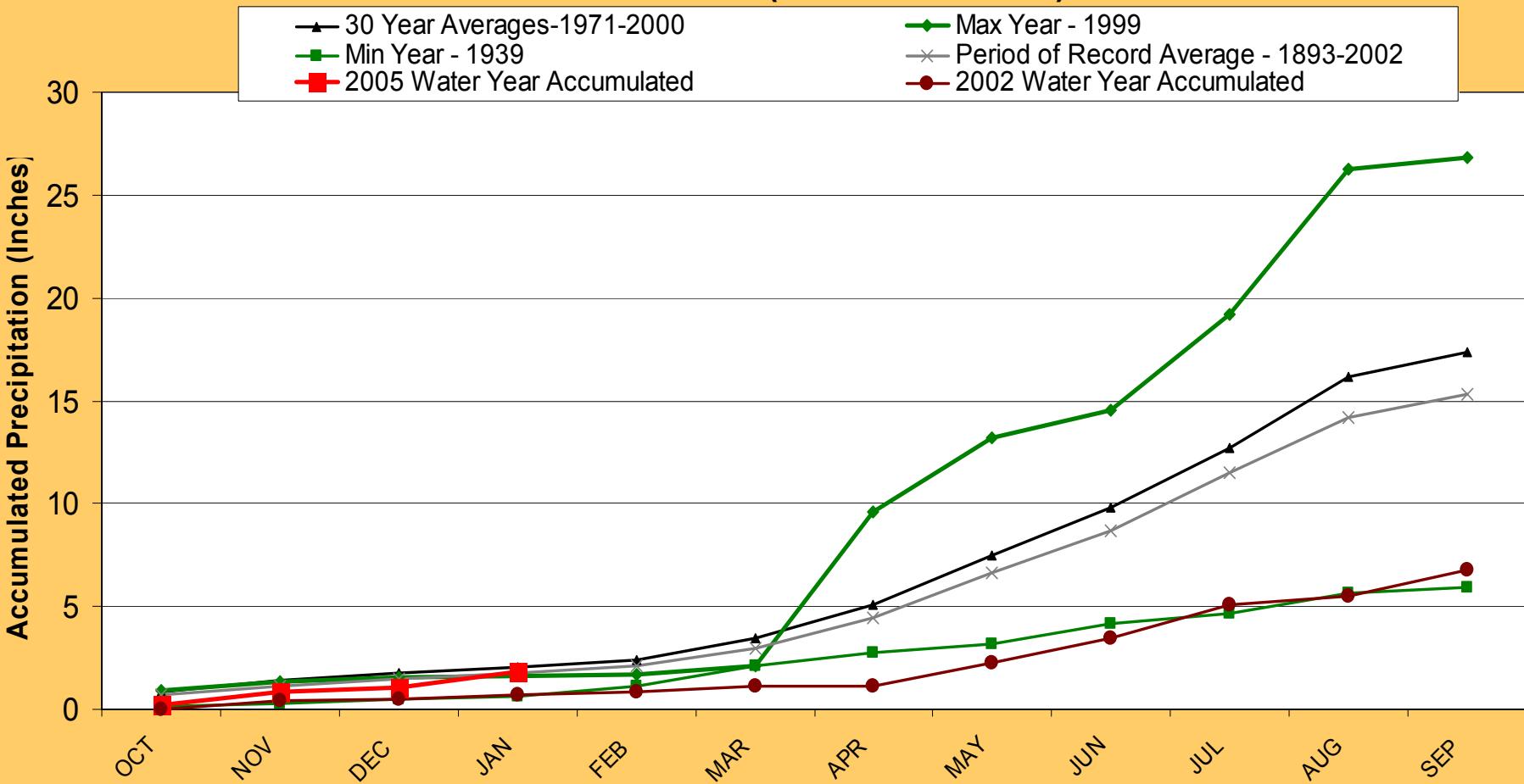
Reservoir Levels

**Colorado Statewide Reservoir Levels on October 1st
for Years 1997-2004**



Colorado Springs 2005 Water Year Precipitation

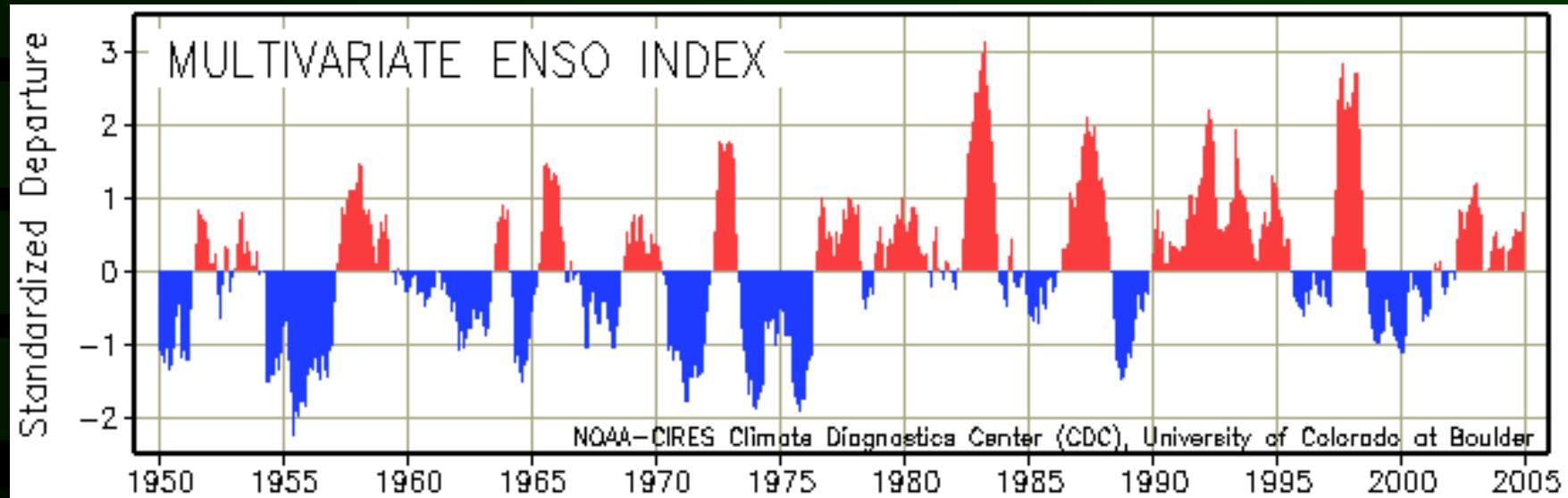
Colorado Springs 2005 Water Year (Oct '04 - Jan '05)



What Comes Next? – Do We Really Know?



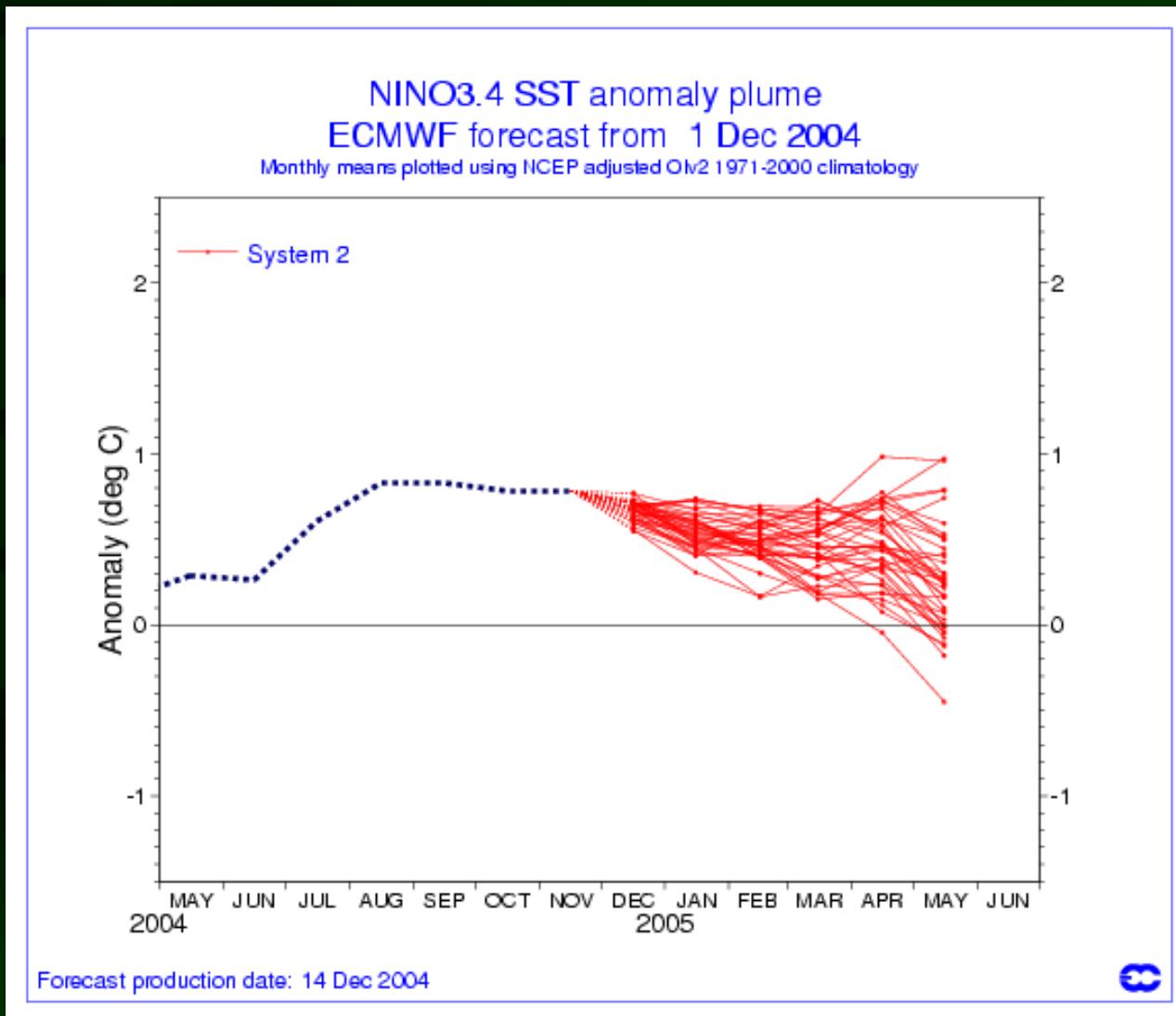
Multivariate ENSO Index (MEI)



Last update: 8 February 2005

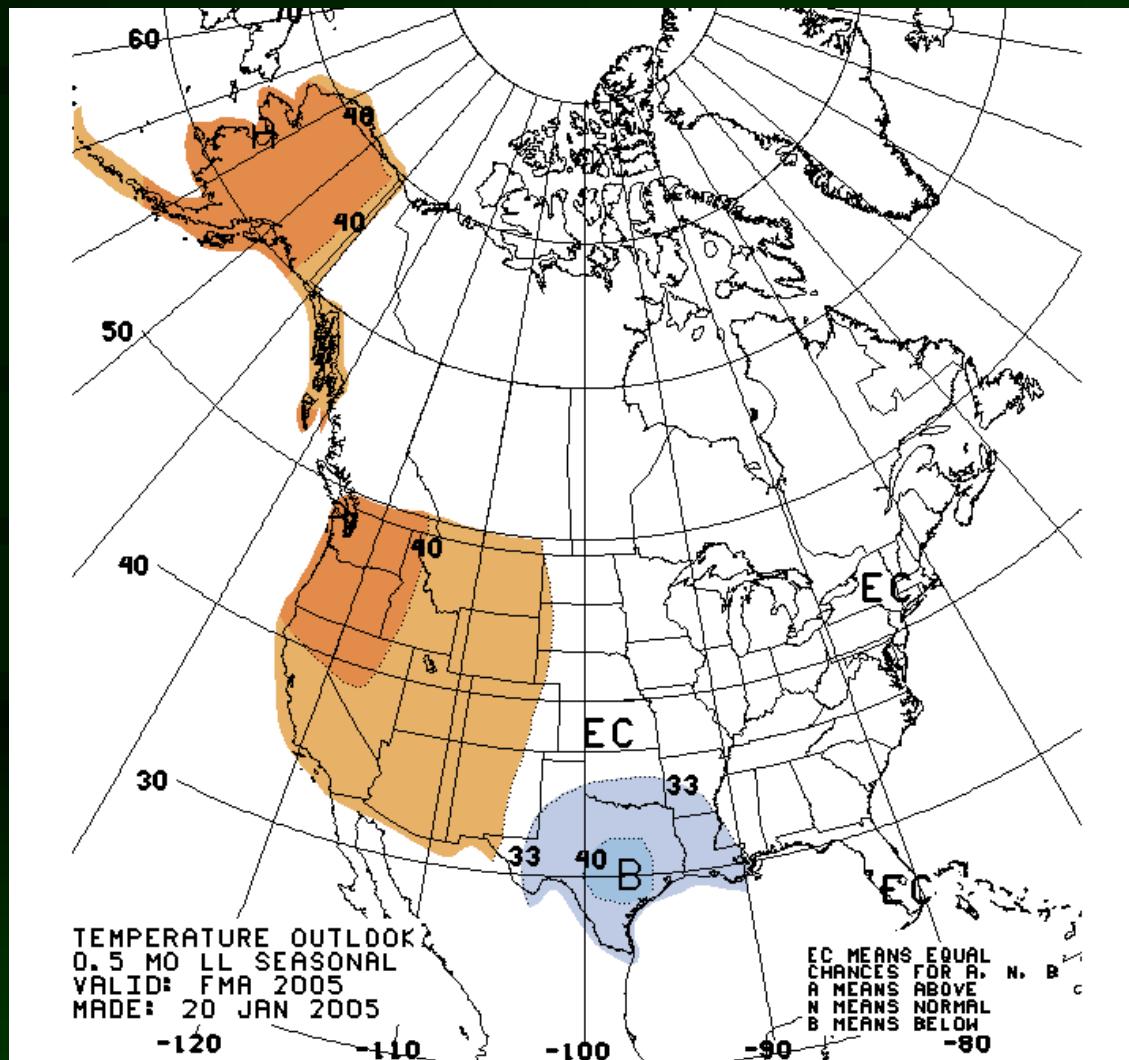
<http://www.cdc.noaa.gov/people/klaus.wolter/MEI/>

El Nino Forecast



<http://www.cdc.noaa.gov/people/klaus.wolter/SWcasts/>

Temperature Feb-Apr 2005

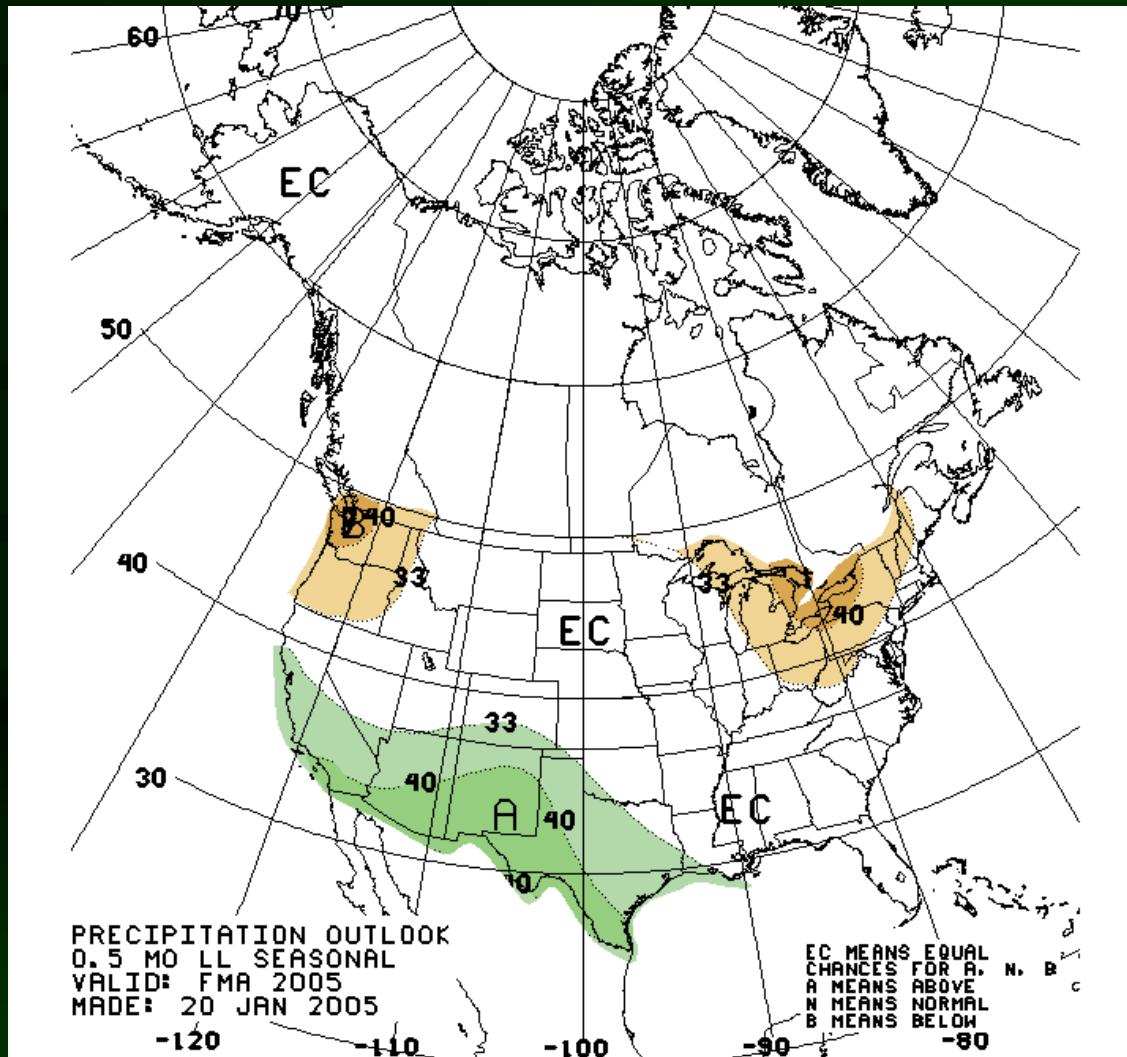


From the Colorado Prediction Center

http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html

Precipitation

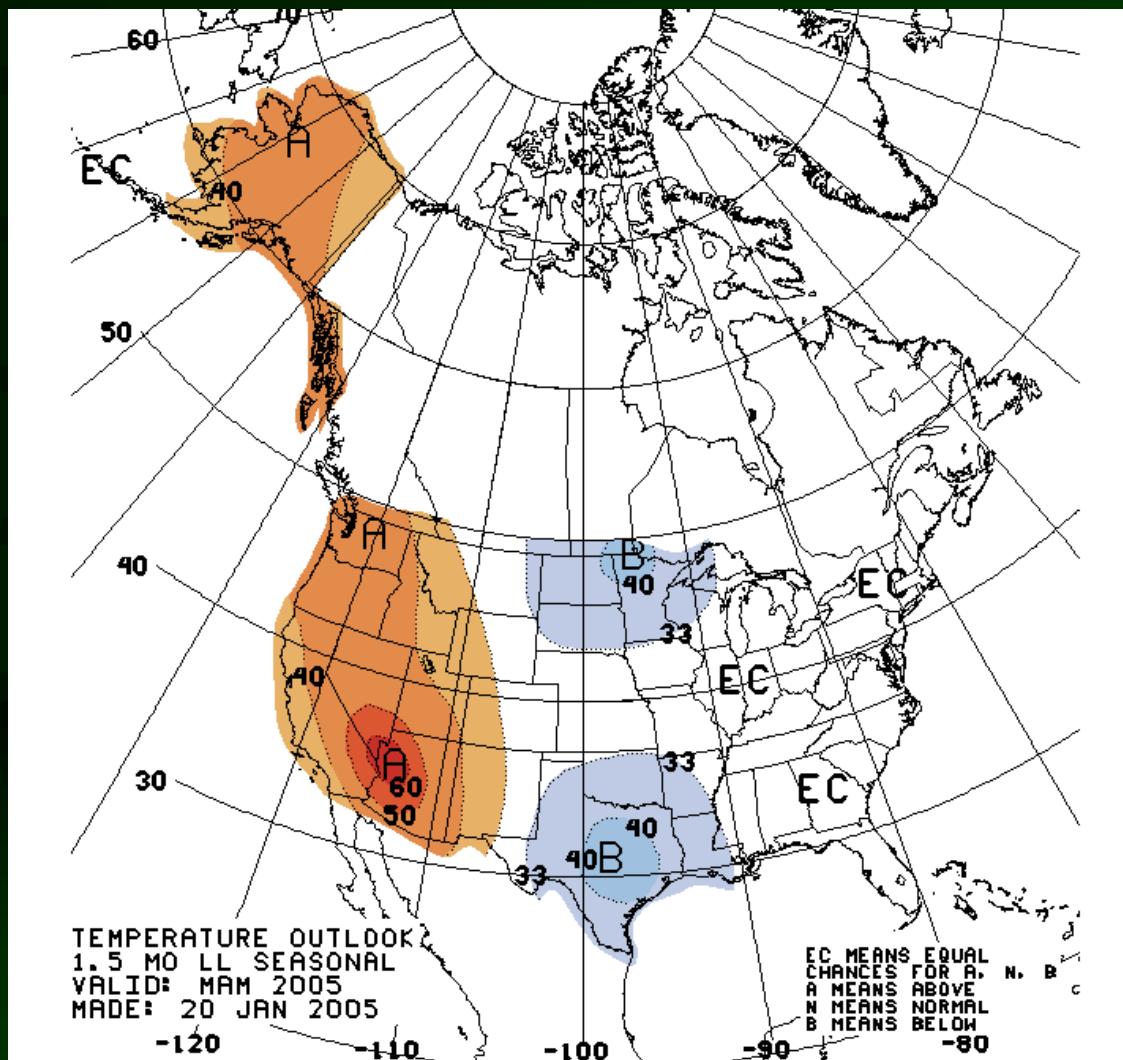
Feb-Apr 2005



From the Colorado Prediction Center

http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html

Temperature Mar-May 2005

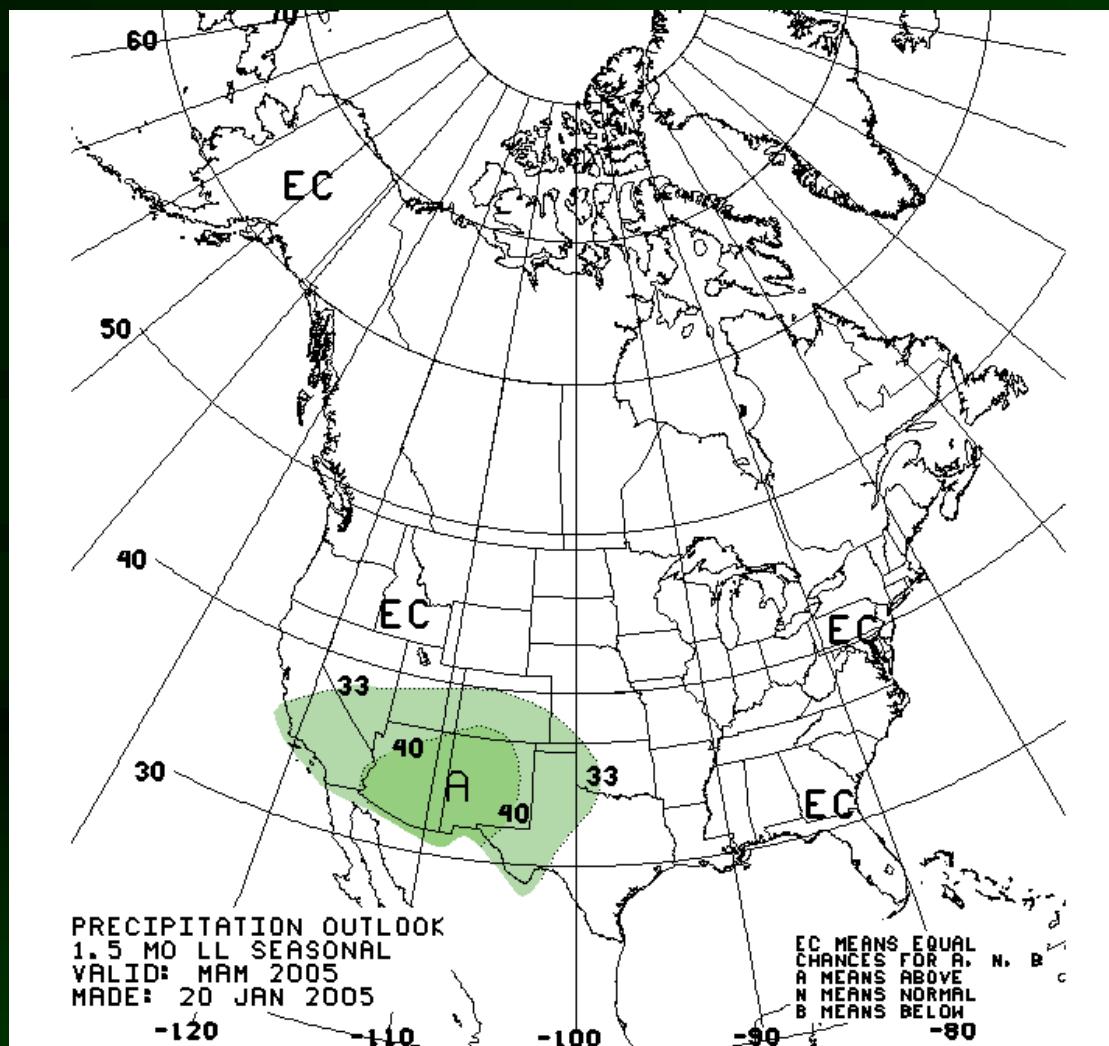


From the Colorado Prediction Center

http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html

Precipitation

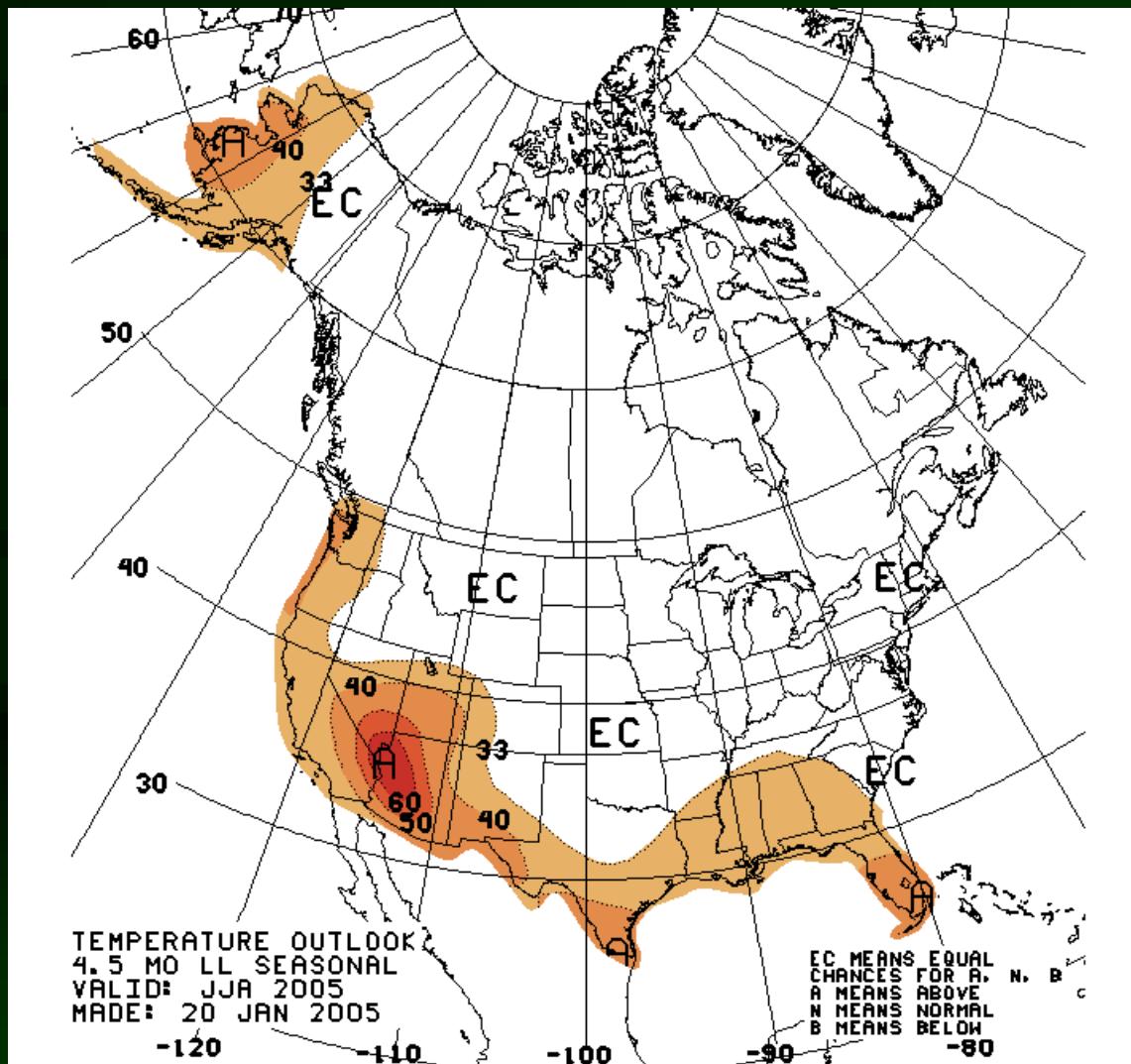
Mar-May 2005



From the Colorado Prediction Center

http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html

Temperature Jun-Aug 2005

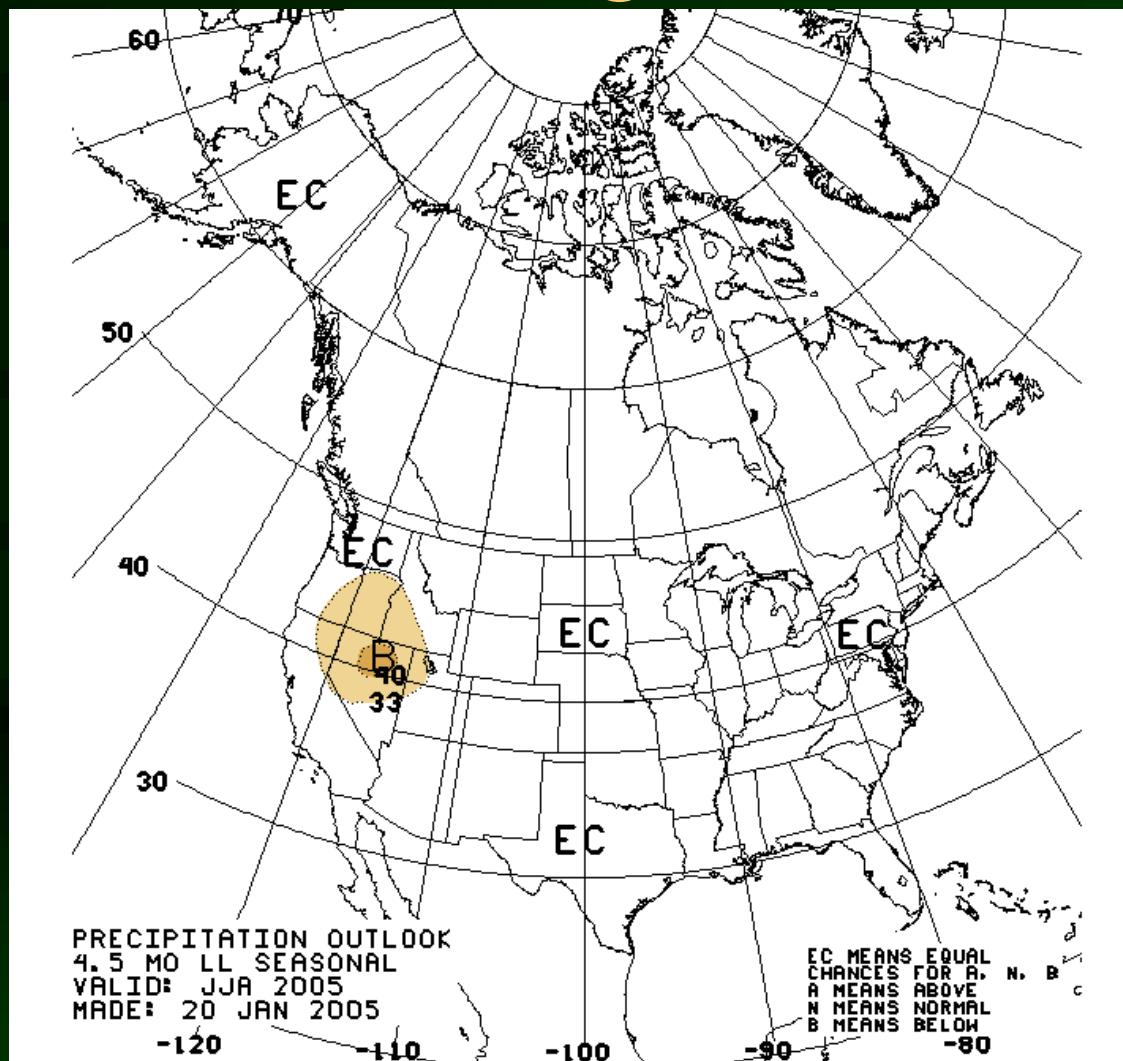


From the Colorado Prediction Center

http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html

Precipitation

Jun-Aug 2005



From the Colorado Prediction Center

http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html

For Colorado Springs,

Average Precipitation = ~ 17 inches

(WY2004 = 20.25 inches)

Average Evaporation = ~ > 24 inches
therefore,

Drought is *NEVER* really over.



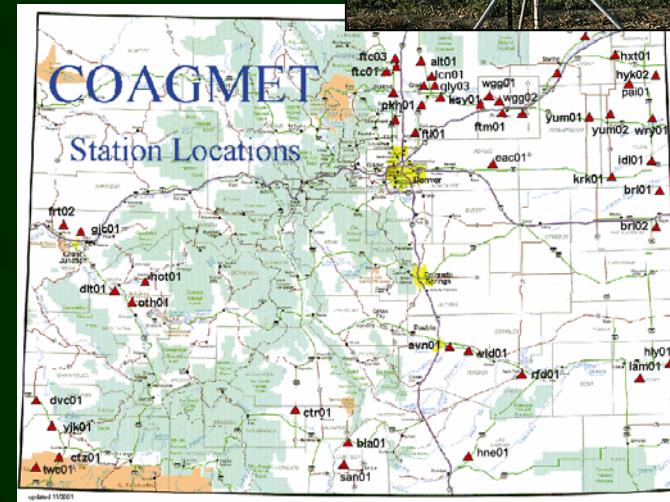
While we may not be able to predict it, at least we should know what we get!



CoAgMet

Weather Data for Agriculture

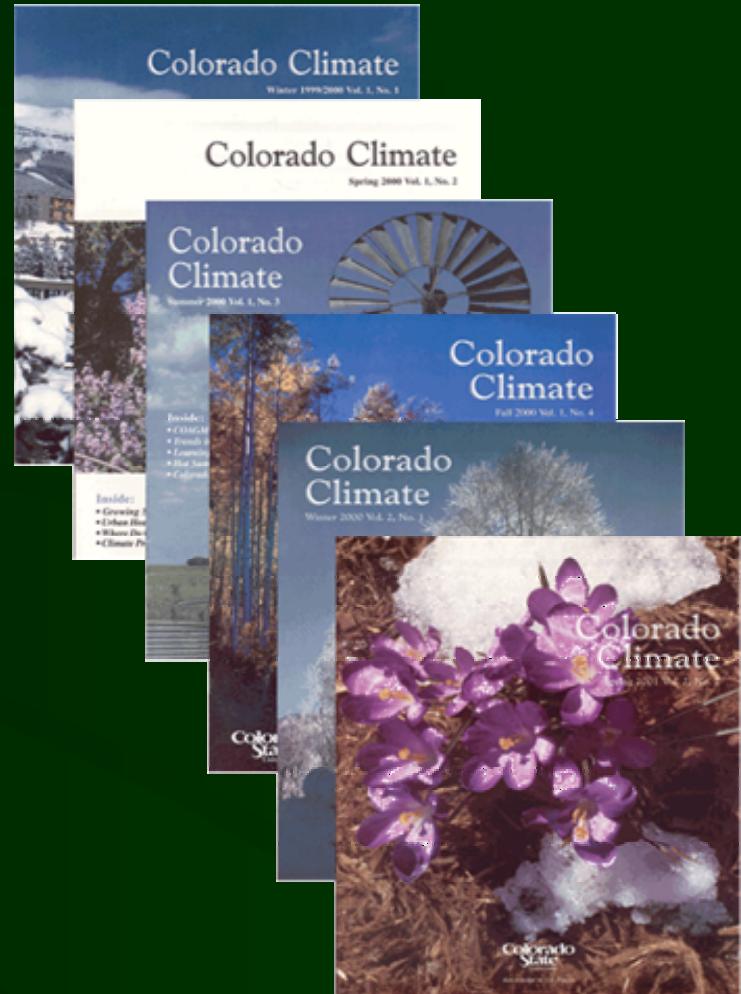
- *Automated weather stations with daily and hourly readings of:*
 - Temperature
 - Humidity
 - Wind
 - Precipitation
 - Solar energy
 - Evapotranspiration



<http://www.coagmet.com>

Colorado Climate Magazine

- *Good bedtime reading about the climate of Colorado -- recent and historic*
- *\$15/year subscription pays printing and mailing costs*



<http://ccc.atmos.colostate.edu/magazine.php>

Colorado Climate Center

Colorado State University

- *Data and Power Point Presentations available for downloading*
- <http://ccc.atmos.colostate.edu>
click on “Drought”
then click on “Presentations”



El Paso County's RainCheck Program

 rain✓check.org  TECHNOLOGY SERVICE CORPORATION

[home](#) [volunteer](#) [data entry](#) [maps](#) [reports](#) [help](#)

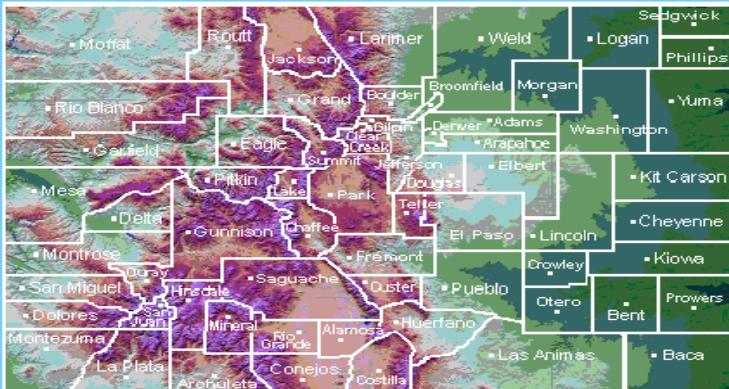
Registered User Login

Username:

Password:

Click on El Paso County for more information.

Rain-Check in Colorado



The map displays the state of Colorado with its 64 counties outlined and labeled. Major cities like Denver, Colorado Springs, and Lakewood are marked. The counties are color-coded in shades of green, purple, and blue.

What's New ... (last updated Jan 12, 2005)

As we head into 2005, all of us involved in the program want to say thanks to all our Rain-Check volunteers, especially those of you who are reporting diligently on a daily basis. The number of volunteers nearly doubled during 2004 and we hope to double the number of volunteers again this year. Getting quality data from as many volunteers as possible throughout the region is extremely important to understanding the precipitation patterns of El Paso County. During this year we also hope to increase our partnership with the CoCo RaHS (<http://ccc.atmos.colostate.edu/~hail/>) program and share data back and forth in real-time to give a better state and region wide look at the precipitation. Remember, your data is very important to many citizens, the scientific community, and industries throughout the area. Please continue to report as often as possible and be sure the quality of your data is the highest possible. If you have any questions feel free to contact bkappel@tsc.com. Also, if you are no longer using your rain gauge, we have many other volunteers who would love to join and could put your gauge into use, so please send an email and let us know. Please read through the second paragraph and use the information under the "Help" tab to ensure you are recording and reporting snow and winter precipitation properly.

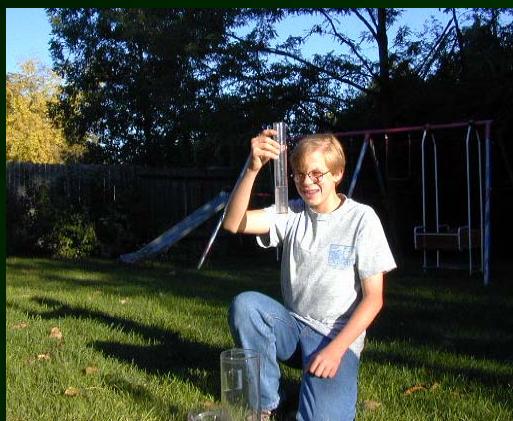
Snowfall is the most difficult type of precipitation to measure. Therefore, be sure to use your common sense and please be sure to review the proper techniques for measuring snowfall, liquid equivalent precipitation, and snowdepth available under the Help tab. Remember, snowfall is measured to the nearest 1/10th of an inch and snow depth is measured to the nearest whole inch. For example, you may report 3.4" of new snowfall over the last 24 hours, 0.34" of liquid equivalent, and with a 3" snowdepth. Also, anytime you report snow, you should also report a liquid equivalent amount; please be sure to do both. A final important note, especially in Fall and Spring, sometimes most or all of the snow that falls melts before you have a chance to measure it. When this happens, use the liquid amount to estimate the





CoCoRaHS

Community Collaborative Rain, Hail, and Snow Network



<http://www.cocorahs.org>

- Over 1,000 volunteers participate in rain, hail and snow measurements.
- More accurate maps, verifies forecasting, radar research, crop damage, drought/flooding, educational purposes.

CoCo RaHS

Volunteers of all ages helping scientists study storms.
The exploration begins in your back yard!



What Does It Take To Be A Volunteer?

- Scientific curiosity.
- An interest in weather and an appreciation for water.
- Enough unobstructed space to install a rain gauge.
- Two minutes a day for a good cause.



Photograph by Gerry Pearson

CoCo RaHS

Simple Tools to Study Rain

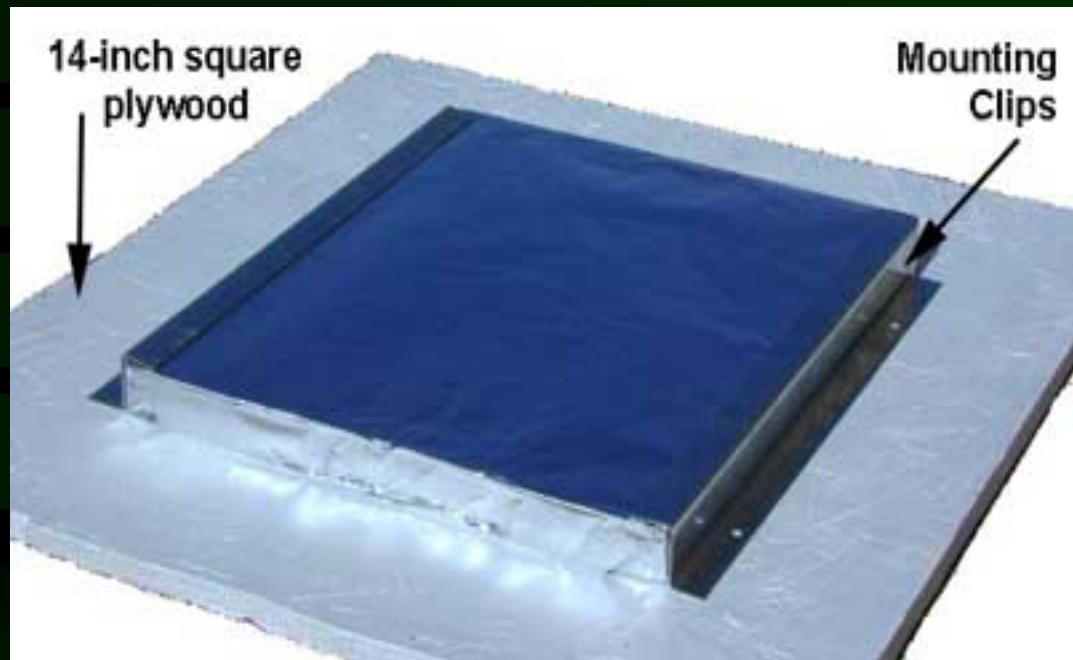
Rain Gauge



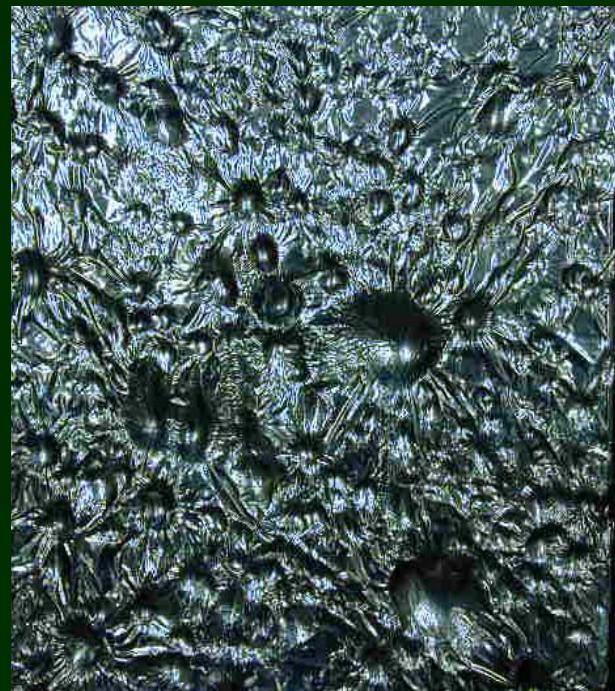
Example Station

CoCo RaHS

Simple Tools To Study Hail

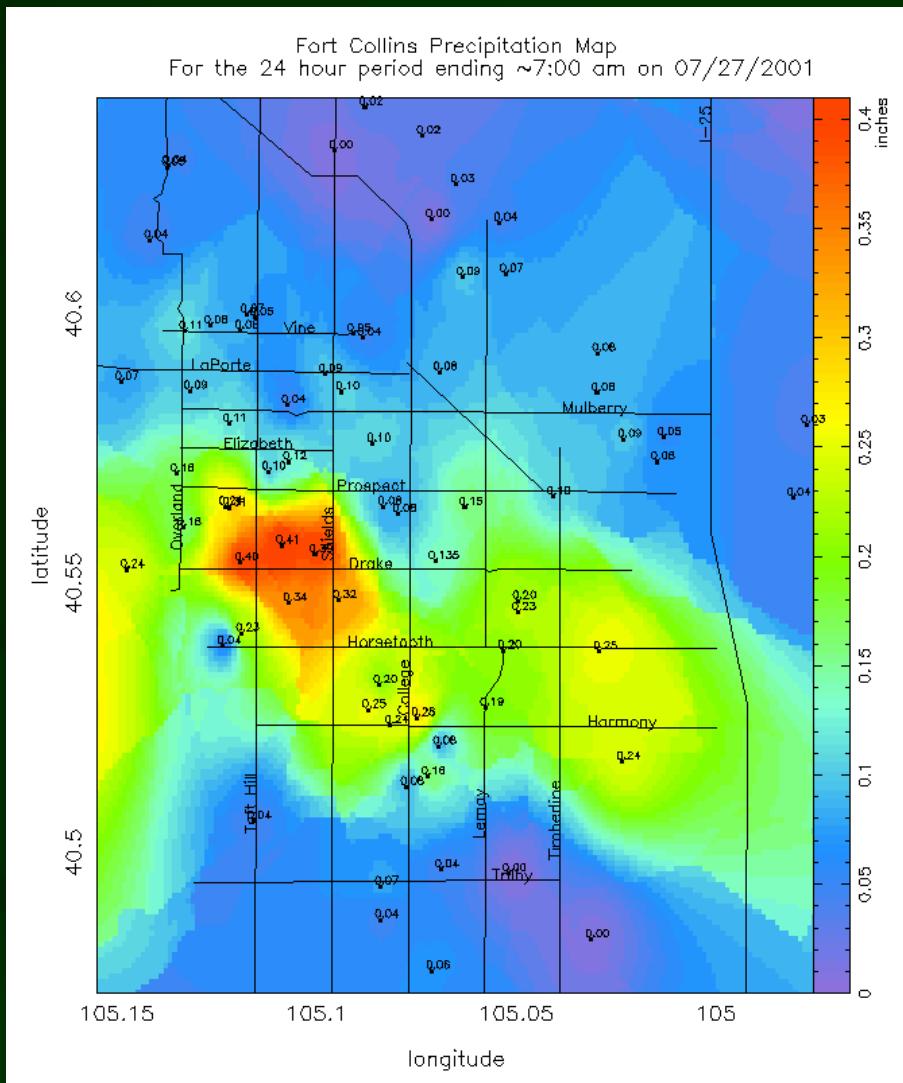
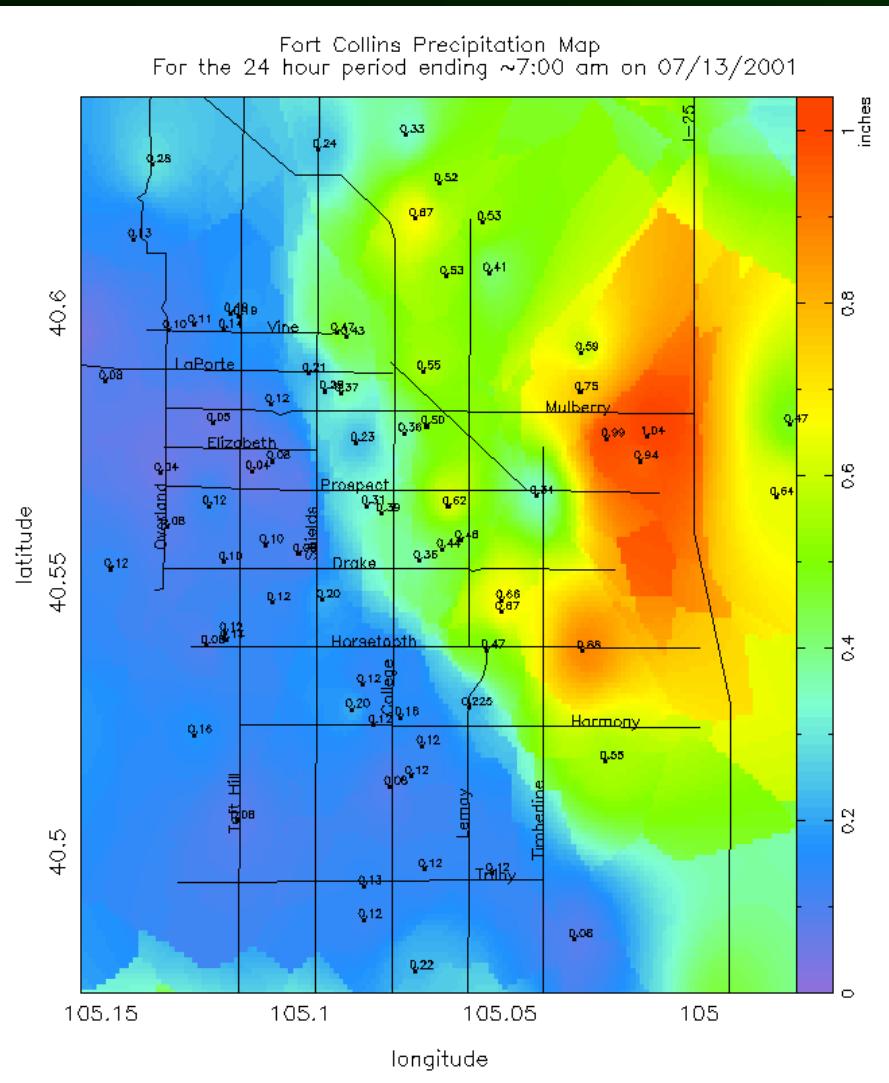


Hail Pad



Damaged Hail Pad

Fort Collins Daily Rainfall Examples



Colorado Hailstorm

July 10, 2002, Parker, CO



Damaged Hailpad.



One of the culprits.

COLORADO

How many volunteers do we need?



- Our goal is at least one per square mile over urbanized areas.
- As many as we can find in rural areas.

For more information visit the
CoCoRaHS Web site

<http://www.cocorahs.org>



Support for this project provided by
Informal Science Education Program,
National Science Foundation
and
many local charter sponsors.